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page 6 Exercise 5

1. 3, 11, 19, 23, 29, 31, 37, 47, 59, 61, 67, 73
2. (a) 4, 8, 12, 16, 20 (b) 6, 12, 18, 24, 30 (c) 10, 20, 30, 40, 50
(d) 11, 22, 33, 44, 55 (e) 20, 40, 60, 80, 100
3. 12 and 24 4. 15
5. (a) 1, 2, 3, 6 (b) 1, 3, 9 (c) 1, 2, 5, 10,
(d) 1, 3, 5, 15 (e) 1, 2, 3, 4, 6, 8, 12, 24 (f) 1, 2, 4, 8, 16, 32
6. (a) rational (b) rational (c) irrational (d) rational (e) rational (f) irrational
(g) rational (h) irrational (i) irrational (j) rational (k) rational (l) irrational
7. (a) Yes. Divide by 3, 5, 7, 11, 13, (i.e. odd prime numbers $< \sqrt{263}$)
(b) No
(c) Prime numbers $< \sqrt{1147}$
8. 2, 3, 5, 41, 67, 89

page 6 Exercise 6

1. 18, 22 2. 30, 37 3. 63, 55 4. -7, -12 5. 21, 27 6. 2, -5
7. 16, 22 8. 16, 32 9. 25, 15 10. -4, -10 11. -4, -3 12. $7\frac{1}{2}$, $3\frac{3}{4}$
13. $\frac{1}{3}$, $\frac{1}{9}$ 14. $2\frac{2}{3}$ 15. 32, 47 16. 840, 6720 17. 5, -1 18. 2, 1

page 7 Exercise 7

1. Rational: $(\sqrt{17})^2$; $3 \cdot 14$; $\frac{\sqrt{12}}{\sqrt{3}}$; $3^{-1} + 3^{-2}$; $\frac{22}{7}$; $\sqrt{2 \cdot 25}$
2. (a) A 4, B $\sqrt{41}$ (b) A rational, B irrational (c) Both rational (d) B
3. (a) 6π cm, irrational (b) 6 cm, rational (c) 36 cm^2 , rational
(d) $9\pi\text{ cm}^2$, irrational (e) $36 - 9\pi\text{ cm}^2$, irrational
7. (a) No (b) Yes e.g. $\sqrt{8} \times \sqrt{2} = 4$

page 8 Exercise 8

1. (a) $2n$ (b) $10n$ (c) $3n$ (d) $11n$ (e) $100n$ (f) n^2 (g) 10^n (h) n^3
2. $n^2 + 4$ 3. $5n$ 4. 2^n 5. $n(n+2)$ 6. $\frac{n}{n+1}$ 7. $7n$ 8. n^2
9. $\frac{5}{n^2}$ 10. $\frac{n+2}{n}$ 11. $4n-1$ 12. $2n+3$ 13. $9-2n$ 14. $4n-9$

page 9 Exercise 9

1. (a) 8 (b) 8.17 (c) 8.17 2. (a) 20 (b) 19.6 (c) 19.62
3. (a) 20 (b) 20.0 (c) 20.04 4. (a) 1 (b) 0.815 (c) 0.81
5. (a) 311 (b) 311 (c) 311.14 6. (a) 0 (b) 0.275 (c) 0.28
7. (a) 0 (b) 0.00747 (c) 0.01 8. (a) 16 (b) 15.6 (c) 15.62
9. (a) 900 (b) 900 (c) 900.12 10. (a) 4 (b) 3.56 (c) 3.56
11. (a) 5 (b) 5.45 (c) 5.45 12. (a) 21 (b) 21.0 (c) 20.96
13. (a) 0 (b) 0.0851 (c) 0.09 14. (a) 1 (b) 0.515 (c) 0.52
15. (a) 3 (b) 3.07 (c) 3.07 16. 5.7 17. 0.8 18. 11.2
19. 0.1 20. 0.0 21. 11.1

page 10 Exercise 10

1. 195.5 cm 2. 36.5 kg 3. 3.25 kg 4. 95.55 m 5. 28.65 s
6. (a) 1.5, 2.5 (b) 2.25, 2.35 (c) 63.5, 64.5 (d) 13.55, 13.65

7. B 8. C 9.(a) Not necessarily (b) 1 cm
 10. (a) $16.5 \leq m < 17.5$ (b) $255.5 \leq d < 256.5$ (c) $2.35 \leq l < 2.45$ (d) $0.335 \leq m < 0.345$
 (e) $2.035 \leq v < 2.045$ (f) $11.95 \leq x < 12.05$ (g) $81.35 \leq T < 81.45$ (h) $0.25 \leq M < 0.35$
 (i) $0.65 \leq m < 0.75$ (j) $51\,500 \leq n < 52\,500$
 11. No, max. card length 11.55 cm, min. envelope length 11.5 cm

page 11 Exercise 11

1. (a) 7.5, 8.5, 10.5 cm (b) 26.5 cm 2. 46.75 cm^2
 3. (a) 7 (b) 5 (c) 10 (d) 4 (e) 2 (f) 5 (g) 2 (h) 24
 4. (a) 13 (b) 11 (c) 3 (d) 12.5
 5. (a) 10.5 (ii) 4.3 6. (i) 13, 11 (ii) 3, 1 (iii) 0.8, 0.6
 7. 56 cm^2 8. 55.7

page 12 Exercise 12

1. 70.56 2. 118.958 3. 451.62 4. 33 678.8 5. 0.6174
 6. 1068 7. 19.53 8. 18 914.4 9. 38.72 10. 0.009 79
 11. 2.4 12. 11 13. 41 14. 8.9 15. 4.7
 16. 56 17. 0.0201 18. 30.1 19. 1.3 20. 0.31
 21. 210.21 22. 294 23. 282.131 24. 35 25. 242

page 13 Exercise 13

1. 4×10^3 2. 5×10^2 3. 7×10^4 4. 6×10 5. 2.4×10^3
 6. 3.8×10^2 7. 4.6×10^4 8. 4.6×10 9. 9×10^5 10. 2.56×10^3
 11. 7×10^{-3} 12. 4×10^{-4} 13. 3.5×10^{-3} 14. 4.21×10^{-1} 15. 5.5×10^{-5}
 16. 1×10^{-2} 17. 5.64×10^5 18. 1.9×10^7 19. 1.1×10^9 20. 1.67×10^{-24}
 21. 5.1×10^8 22. 2.5×10^{-10} 23. 6.023×10^{23} 24. 3×10^{10} 25. $\$3.6 \times 10^6$

page 14 Exercise 14

1. 1.5×10^7 2. 3×10^8 3. 2.8×10^{-2} 4. 7×10^{-9} 5. 2×10^6
 6. 4×10^{-6} 7. 9×10^{-2} 8. 6.6×10^{-8} 9. 3.5×10^{-7} 10. 1×10^{-16}
 11. 8×10^9 12. 7.4×10^{-7} 13. c, a, b 14. 13 15. 16
 16. (i) 9×10^2 , 4×10^2 (ii) 1×10^8 , 4×10^7
 17. 50 min 18. 6×10^2 19. (a) 20.5 s (b) 6.3×10^{91} years

page 15 Exercise 15

1. 1 : 3 2. 1 : 6 3. 1 : 50 4. 1 : 1.6 5. 1 : 0.75
 6. 1 : 0.375 7. 1 : 25 8. 1 : 8 9. 2.4 : 1 10. 2.5 : 1
 11. 0.8 : 1 12. 0.02 : 1 13. \$15, \$25 14. \$36, \$84 15. 140 m 110 m
 16. \$18, \$27, \$72 17. 15 kg, 75 kg, 90 kg 18. 46 min, 69 min, 69 min
 19. £39 20. 18 kg, 36 kg, 54 kg, 72 kg 21. \$400, \$1000, \$1000, \$1600
 22. 5 : 3 23. \$200 24. 3 : 7 25. $\frac{1}{7}x$ 26. 6
 27. 12 28. \$120 29. 300 g 30. 625

page 17 Exercise 16

1. \$1.68 2. \$84 3. 6 days 4. $2\frac{1}{2}$ litres 5. 60 km
 6. 119 g 7. \$68.40 8. $2\frac{1}{4}$ weeks 9. 80 c 10. (a) 12; (b) 2100

11. 4 12. 5-6 days 13. \$175 14. 540° 15. \$1.20
 16. 190 m 17. 1250 18. 11.2 h 19. 57.1 min 20. 243 kg
 21. 12 days

page 18 Exercise 17

1. (a) €18.60 (b) £44.10 (c) \$202 (d) €1.40 (e) 8.63 rials (f) 0.27 dinars
 2. (a) \$537.63 (b) \$3968.25 (c) \$8.06 (d) \$3000 (e) \$124 (f) \$200
 3. £3.39 4. Cheaper in UK by \$2 5. \$35 333
 6. Britain £15 000, USA £16 306, France £18 579 7. €752.69

page 20 Exercise 18

1. (a) 70 m (b) 16 m (c) 3.55 m (d) 108.5 m
 2. (a) 5 cm (b) 3.5 cm (c) 0.72 cm (d) 2.86 cm
 3. (a) 450 000 cm (b) 4500 m (c) 4.5 km
 4. 12.3 km 5. 4.71 km 6. 50 cm 7. 64 cm 8. 5.25 cm

page 21 Exercise 19

1. 40 m by 30 m; 12 cm²; 1200 m² 2. 1 m², 6 m² 3. 0.32 km² 4. 50 cm²
 5. 150 km² 6. 0.75 hectares 7. 240 cm² 8. 1 : 50 000

page 22 Exercise 20

1. (a) $\frac{3}{5}$ (b) $\frac{6}{25}$ (c) $\frac{7}{20}$ (d) $\frac{1}{50}$
 2. (a) 25% (b) 10% (c) 87 $\frac{1}{2}$ % (d) 33 $\frac{1}{3}$ % (e) 72% (f) 31%
 3. (a) 0.36 (b) 0.28 (c) 0.07 (d) 0.134 (e) 0.6 (f) 0.875
 4. (a) 45%; $\frac{1}{2}$; 0.6 (b) 4%; $\frac{6}{16}$; 0.38 (c) 11%; 0.111; $\frac{1}{9}$ (d) 0.3; 32%; $\frac{1}{3}$
 5. (a) 85% (b) 77.5% (c) 23.75% (d) 56% (e) 10% (f) 37.5%

page 23 Exercise 21

1. (a) \$15 (b) 900 kg (c) \$2.80 (d) 125
 2. \$32 3. 13.2c 4. 52.8 kg
 5. (a) \$1.02 (b) \$21.58 (c) \$2.22 (d) \$0.53
 6. \$243.28 7. \$26 182 8. 96.8% 9. 77.5% 10. \$71.48
 11. 200 12. 29 000 13. 500 cm 14. \$6.30 15. 400 kg
 16. 325 17. \$35.25 18. \$8425.60

page 25 Exercise 22

1. (a) 25%, profit (b) 25%, profit (c) 10%, loss (d) 20%, profit
 (e) 30%, profit (f) 7.5%, profit (g) 12%, loss (h) 54%, loss
 2. 28% 3. 44 $\frac{4}{9}$ % 4. 46.9% 5. 12% 6. 5 $\frac{1}{3}$ %
 7. (a) \$50 (b) \$450 (c) \$800 (d) \$12.40
 8. \$500 9. \$12 10. \$5 11. 60c 12. \$2200
 13. 14.3% 14. 20% 15. 8 : 11 16. 21% 17. 20%

page 26 Exercise 23

1. (a) \$216 (b) \$115.50 (c) 2 years (d) 5 years
 2. \$2295, \$9045 3. 7.5%

page 27 Exercise 24

1. (a) £2180 (b) £2376.20 (c) £2590.06 2. (a) £5550 (b) £6838.16 (c) £8425.29
 3. £13 107.96 4. (a) £36 465.19 (b) £40 202.87
 5. (a) £95 400 (b) £107 191 (c) £161 176
 6. (a) £14 033 (b) £734 (c) £107 946
 7. £9211.88 8. 8 years 9. 12 years 10. 13 years 11. £30 000 at 8%

page 29 Exercise 25

1. (a) $2\frac{1}{2}$ h (b) $3\frac{1}{8}$ h (c) 75 s (d) 4 h
 2. (a) 20 m/s (b) 30 m/s (c) $83\frac{1}{3}$ m/s (d) 108 km/h (e) 79.2 km/h
 (f) 1.2 cm/s (g) 90 m/s (h) 25 mph (i) 0.03 miles per second
 3. (a) 75 km/h (b) 4.52 km/h (c) 7.6 m/s (d) 4×10^6 m/s (e) 2.5×10^8 m/s
 (f) 200 km/h (g) 3 km/h
 4. (a) 110 000 m (b) 10 000 m (c) 56 400 m (d) 4500 m (e) 50 400 m
 (f) 80 m (g) 960 000 m
 5. (a) 3.125 h (b) 76.8 km/h 6. (a) 4.45 h (b) 23.6 km/h
 7. 46 km/h 8. (a) 8 m/s (b) 7.6 m/s (c) 102.63 s (d) 7.79 m/s
 9. 1230 km/h 10. 3 h 11. 100 s 12. $1\frac{1}{2}$ minutes 13. 600 m
 14. $53\frac{1}{3}$ s 15. 5 cm/s 16. 60 s 17. 120 km/h

page 30 Exercise 26

1. $\frac{7}{25}$, 0.28, 28%; $\frac{16}{25}$, 0.64, 64%; $\frac{5}{8}$, 0.625, $62\frac{1}{2}\%$ 2. 12.4 m
 3. 3.08 kg 4. $56\frac{1}{4}$ km 5. \$820 6. A
 7. (a) 19:17 (b) 23:49 8. \$36 9. 1.32

page 31 Exercise 27

1. 1.08×10^9 km 2. 167 days 3. 3 h 21 min 4. 17
 5. (a) \$4.95 (b) 25 (c) \$11.75 6. 30 g zinc, 2850 g copper, 3000 g total

page 32 Exercise 28

1. 2 : 1 2. (a) 9.85 (b) 76.2 (c) 223 512 (d) 1678.1
 3. 252 000 4. (a) 8 (b) 24 (c) 8 (d) 8
 5. 0.18 s 6. \$140 7. 5 8. THIS IS A VERY SILLY CODE 9. 29

page 34 Exercise 29

1. 3.041 2. 1460 3. 0.030 83 4. 47.98 5. 130.6
 6. 0.4771 7. 0.3658 8. 37.54 9. 8.000 10. 0.6537
 11. 0.037 16 12. 34.31 13. 0.7195 14. 3.598 15. 0.2445
 16. 2.043 17. 0.3798 18. 0.7683 19. -0.5407 20. 0.070 40
 21. 2.526 22. 0.094 78 23. 0.2110 24. 3.123 25. 2.230
 26. 128.8 27. 4.268 28. 3.893 29. 0.6290 30. 0.4069
 31. 9.298 32. 0.1010 33. 0.3692 34. 1.125 35. 1.677
 36. 0.9767 37. 0.8035 38. 0.3528 39. 2.423 40. 1.639
 41. 0.000 465 9 42. 0.3934 43. -0.7526 44. 2.454 45. 40 000
 46. 0.070 49 47. 405 400 48. 471.3 49. 20 810 50. 2.218×10^6
 51. 1.237×10^{-24} 52. 3.003 53. 0.035 81 54. 47.40 55. -1748

56. 0.011 38 57. 1757 58. 0.026 35 59. 0.1651 60. 5447
 61. 0.006 562 62. 0.1330 63. 0.4451 64. 0.036 16 65. 19.43
 66. 1.296×10^{-15} 67. 5.595×10^{14} 68. 1.022×10^{-8} 69. 0.019 22 70. 0.9613

page 38 *Revision exercise 1A*

1. (a) 185 (b) 150 (c) 40 (d) $\frac{11}{12}$ (e) $2\frac{4}{5}$ (f) $\frac{2}{3}$
 2. 128 cm 3. $\frac{2}{5}$ 4. $\frac{a}{b}$ 5. (a) 0.0547 (b) 0.055 (c) 5.473×10^{-2}
 6. 1.238 7. (a) 3×10^7 (b) 3.7×10^4 (c) 2.7×10^{13}
 8. (a) \$26 (b) 6 : 5 (c) 6 9. \$75
 10. (a) (i) 57.2% (ii) $87\frac{1}{2}\%$ (b) 40% (c) 80 c 11. 5%
 12. (a) \$500 (b) $37\frac{1}{2}\%$ 13. £357.88 14. 3.05
 15. (a) 2.4 km (b) 1 km² 16. (a) 300 m (b) 60 cm (c) 150 cm²
 17. (a) 1 : 50 000 (b) 1 : 4 000 000 18. (a) 22% (b) 20.8% (c) \$240
 19. (a) (i) 7 m/s (ii) 200 m/s (iii) 5 m/s (b) (i) 144 km/h (ii) 2.16 km/h
 20. (a) 0.005 m/s (b) 1.6 s (c) 172.8 km 21. $33\frac{1}{3}$ km/h
 22. (a) 3 (b) 10 (c) 1, 9 (d) 1, 8 (e) $m = 3, n = 9$
 (f) $p = 1, q = 3, r = 9, s = 8, t = 10$ 23. About 3 24. 2.3×10^9
 25. (a) 600 (b) 10 000 (c) 3 (d) 20
 26. (a) 0.5601 (b) 3.215 (c) 0.6161 (d) 0.4743
 27. (a) 0.340 (b) 4.08×10^{-6} (c) 64.9 (d) 0.119
 28. 33.1%

page 41 *Examination exercise 1B*

1. 17 : 40 2. \$570 3. (a) = (b) < 4. (a) 5 km (b) 150 hectares
 5. (a) 82%, $\sqrt{0.64}$, $\frac{82}{99}$ (b) 0.0083 6. (a) (i) 18 000 children (ii) 96 000 people
 6. (b) 35 000 women (c) (i) 5760 boys, 6240 girls (ii) 10.72 years
 7. (a) \$750 (b) (i) $2.5x + 5(200 - x) = 905$ (ii) $x = 38$ (c) (i) \$6300 (ii) \$105
 8. (a) $\$4250 = \frac{25}{100} \times \$17\,000$ (b) \$4800 (c) (i) $\frac{30}{100} \times (20\,000 - x)$ (ii) \$3500
 9. (a) $135 = 3 \times 3 \times 3 \times 5$; $210 = 2 \times 3 \times 5 \times 7$; $1120 = 2^5 \times 5 \times 7$
 (b) (i) 5 (ii) e (iii) 210 and 1120
 (c) $a = 1, b = 9, c = 6, d = 3, e = 5, f = 4, g = 2, h = 7, i = 8$
 10. (a) 121 (b) $(n + 1)^2$ 11. (a) $-1, \sqrt{36}$ (b) $\sqrt{2}, \sqrt{30}$
 12. $I = \frac{mr}{5}$ 13. 66.7% 14. (a) 50.3% (b) (i) 4 710 000 (ii) 7.087×10^6

2 Algebra 1

page 45 *Exercise 1*

1. 13 2. 211 3. -12 4. -31 5. -66 6. 6.1
 7. 9.1 8. -35 9. 18.7 10. -9 11. -3 12. 3
 13. -2 14. -14 15. -7 16. 3 17. 181 18. -2.2
 19. 8.2 20. 17 21. 2 22. -6 23. -15 24. -14
 25. -2 26. -12 27. -80 28. -13.1 29. -4.2 30. 12.4
 31. -7 32. 8 33. 4 34. -10 35. 11 36. 4
 37. -20 38. 8 39. -5 40. -10 41. -26 42. -21

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|----------|---------|-----------|---------|----------|---------|
| 43. 8 | 44. 1 | 45. -20.2 | 46. -50 | 47. -508 | 48. -29 |
| 49. 0 | 50. -21 | 51. -0.1 | 52. -4 | 53. 6.7 | 54. 1 |
| 55. -850 | 56. 4 | 57. 6 | 58. -4 | 59. -12 | 60. -31 |

page 46 Exercise 2

- | | | | | | |
|-----------|-------------------|--------------------|----------|-------------------|--------------------|
| 1. -8 | 2. 28 | 3. 12 | 4. 24 | 5. 18 | 6. -35 |
| 7. 49 | 8. -12 | 9. -2 | 10. 9 | 11. -4 | 12. 4 |
| 13. -4 | 14. 8 | 15. 70 | 16. -7 | 17. $\frac{1}{4}$ | 18. $-\frac{3}{5}$ |
| 19. -0.01 | 20. 0.0002 | 21. 121 | 22. 6 | 23. -600 | 24. -1 |
| 25. -20 | 26. -2.6 | 27. -700 | 28. 18 | 29. -1000 | 30. 640 |
| 31. -6 | 32. -42 | 33. -0.4 | 34. -0.4 | 35. -200 | 36. -35 |
| 37. -2 | 38. $\frac{1}{2}$ | 39. $-\frac{1}{4}$ | 40. -90 | | |

page 46 Exercise 3

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|----------|---------------------|---------|----------|--------------------|---------|
| 1. -10 | 2. 1 | 3. 12 | 4. -28 | 5. -2 | 6. 16 |
| 7. -3 | 8. 14 | 9. -28 | 10. 4 | 11. $-\frac{1}{6}$ | 12. 9 |
| 13. -30 | 14. 24 | 15. -1 | 16. -2 | 17. -30 | 18. 7 |
| 19. 3 | 20. 16 | 21. 93 | 22. 2400 | 23. 10 | 24. 1 |
| 25. -4 | 26. 48 | 27. -1 | 28. 0 | 29. -8 | 30. 170 |
| 31. -3 | 32. 1 | 33. 1 | 34. 0 | 35. 15 | 36. 5 |
| 37. -2.4 | 38. -180 | 39. 5 | 40. -994 | 41. 2 | 42. -48 |
| 43. 60 | 44. -2.5 | 45. -32 | 46. 0 | 47. -0.1 | 48. -16 |
| 49. -4.3 | 50. $-\frac{1}{16}$ | | | | |

page 46 Exercise 4

- | | | | | | | |
|-------|--------------------|----------------|--------|-------------------|-----------------------|----|
| 1. 21 | 2. 1.62 | 3. 396 | 4. 650 | 5. 63.8 | 6. 9×10^{12} | 7. |
| 800 | 8. $ac + ab - a^2$ | 9. $r - p + q$ | | 10. 802; $4n + 2$ | 11. $2n + 6$ | |

page 48 Exercise 5

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|---------|--------|---------|--------|--------|--------|--------|--------|
| 1. 7 | 2. 13 | 3. 13 | 4. 22 | 5. 1 | 6. -1 | 7. 18 | 8. -4 |
| 9. -3 | 10. 37 | 11. 0 | 12. -4 | 13. -7 | 14. -2 | 15. -3 | 16. -8 |
| 17. -30 | 18. 16 | 19. -10 | 20. 0 | 21. 7 | 22. -6 | 23. -2 | 24. -7 |
| 25. -5 | 26. 3 | 27. 4 | 28. -8 | 29. -2 | 30. 2 | 31. 0 | 32. 4 |
| 33. -4 | 34. -3 | 35. -9 | 36. 4 | | | | |

page 49 Exercise 6

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|---------|---------|--------------------|---------|---------|---------------------|
| 1. 9 | 2. 27 | 3. 4 | 4. 16 | 5. 36 | 6. 18 |
| 7. 1 | 8. 6 | 9. 2 | 10. 8 | 11. -7 | 12. 15 |
| 13. -23 | 14. 3 | 15. 32 | 16. 36 | 17. 144 | 18. -8 |
| 19. -7 | 20. 13 | 21. 5 | 22. -16 | 23. 84 | 24. 17 |
| 25. 6 | 26. 0 | 27. -25 | 28. -5 | 29. 17 | 30. $-1\frac{1}{2}$ |
| 31. 19 | 32. 8 | 33. 19 | 34. 16 | 35. -16 | 36. 12 |
| 37. 36 | 38. -12 | 39. 2 | 40. 11 | 41. -23 | 42. -26 |
| 43. 5 | 44. 31 | 45. $4\frac{1}{2}$ | | | |

page 49 Exercise 7

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|--------------------|---------------------|--------------------|---------------------|--------------------|---------------------|
| 1. -20 | 2. 16 | 3. -42 | 4. -4 | 5. -90 | 6. -160 |
| 7. -2 | 8. -81 | 9. 4 | 10. 22 | 11. 14 | 12. 5 or -5 |
| 13. 1 or -1 | 14. $\sqrt{5}$ | 15. 4 | 16. $-6\frac{1}{2}$ | 17. 54 | 18. 25 |
| 19. 4 or -4 | 20. 312 | 21. 45 | 22. 22 | 23. 14 | 24. -36 |
| 25. -7 | 26. 1 or -1 | 27. 901 | 28. -30 | 29. -5 | 30. $7\frac{1}{2}$ |
| 31. -7 | 32. $-\frac{3}{13}$ | 33. 7 | 34. -2 | 35. 0 | 36. $-4\frac{1}{2}$ |
| 37. 6 or -6 | 38. 2 or -2 | 39. 26 | 40. -9 | 41. $3\frac{1}{4}$ | 42. $-\frac{5}{6}$ |
| 43. 4 | 44. $2\frac{2}{3}$ | 45. $3\frac{1}{4}$ | 46. $-2\frac{1}{6}$ | 47. -13 | 48. 12 |
| 49. $1\frac{1}{3}$ | 50. $-\frac{5}{36}$ | | | | |

page 51 Exercise 8

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|--------------------------------|------------------------|------------------------|---------------------------------|---------------------|
| 1. $3x + 11y$ | 2. $2a + 8b$ | 3. $3x + 2y$ | 4. $5x + 5$ | 5. $9 + x$ |
| 6. $3 - 9y$ | 7. $5x - 2y - x^2$ | 8. $2x^2 + 3x + 5$ | 9. $-10y$ | 10. $3a^2 + 2a$ |
| 11. $7 + 7a - 7a^2$ | 12. $5x$ | 13. $\frac{10}{a} - b$ | 14. $\frac{5}{x} - \frac{5}{y}$ | 15. $\frac{3m}{x}$ |
| 6. $\frac{1}{2} - \frac{2}{x}$ | 17. $\frac{5}{a} + 3b$ | 18. $-\frac{n}{4}$ | 19. $7x^2 - x^3$ | 20. $2x^2$ |
| 21. $x^2 + 5y^2$ | 22. $-12x^2 - 4y^2$ | 23. $5x - 11x^2$ | 24. $\frac{8}{x^2}$ | 25. $5x + 2$ |
| 26. $12x - 7$ | 27. $3x + 4$ | 28. $11 - 6x$ | 29. $-5x - 20$ | 30. $7x - 2x^2$ |
| 31. $3x^2 - 5x$ | 32. $x - 4$ | 33. $5x^2 + 14x$ | 34. $-4x^2 - 3x$ | 35. $5a + 8$ |
| 36. $a + 9$ | 37. $ab + 4a$ | 38. $y^2 + y$ | 39. $2x - 2$ | 40. $6x + 3$ |
| 41. $x - 4$ | 42. $7x + 5y$ | 43. $4x^2 - 11x$ | 44. $2x^2 + 14x$ | 45. $3y^2 - 4y + 1$ |
| 46. $12x + 12$ | 47. $4ab - 3a + 14b$ | 48. $2x - 4$ | | |

page 51 Exercise 9

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|-------------------------------|-----------------------|----------------------------|-------------------------|
| 1. $x^2 + 4x + 3$ | 2. $x^2 + 5x + 6$ | 3. $y^2 + 9y + 20$ | 4. $x^2 + x - 12$ |
| 5. $x^2 + 3x - 10$ | 6. $x^2 - 5x + 6$ | 7. $a^2 - 2a - 35$ | 8. $z^2 + 7z - 18$ |
| 9. $x^2 - 9$ | 10. $k^2 - 121$ | 11. $2x^2 - 5x - 3$ | 12. $3x^2 - 2x - 8$ |
| 13. $2y^2 - y - 3$ | 14. $49y^2 - 1$ | 15. $9x^2 - 4$ | 16. $6a^2 + 5ab + b^2$ |
| 17. $3x^2 + 7xy + 2y^2$ | 18. $6b^2 + bc - c^2$ | 19. $-5x^2 + 16xy - 3y^2$ | 20. $15b^2 + ab - 2a^2$ |
| 21. $2x^2 + 2x - 4$ | 22. $6x^2 + 3x - 9$ | 23. $24y^2 + 4y - 8$ | 24. $6x^2 - 10x - 4$ |
| 25. $4a^2 - 16b^2$ | 26. $x^3 - 3x^2 + 2x$ | 27. $8x^3 - 2x$ | 28. $3y^3 + 3y^2 - 18y$ |
| 29. $x^3 + x^2y + x^2z + xyz$ | | 30. $3za^2 + 3zam - 6zm^2$ | |

page 52 Exercise 10

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|----------------------|--------------------------|-----------------------|-----------------------|
| 1. $x^2 + 8x + 16$ | 2. $x^2 + 4x + 4$ | 3. $x^2 - 4x + 4$ | 4. $4x^2 + 4x + 1$ |
| 5. $y^2 - 10y + 25$ | 6. $9y^2 + 6y + 1$ | 7. $x^2 + 2xy + y^2$ | 8. $4x^2 + 4xy + y^2$ |
| 9. $a^2 - 2ab + b^2$ | 10. $4a^2 - 12ab + 9b^2$ | 11. $3x^2 + 12x + 12$ | 12. $9 - 6x + x^2$ |
| 13. $9x^2 + 12x + 4$ | 14. $a^2 - 4ab + 4b^2$ | 15. $2x^2 + 6x + 5$ | 16. $2x^2 + 2x + 13$ |
| 17. $5x^2 + 8x + 5$ | 18. $2y^2 - 14y + 25$ | 19. $10x - 5$ | 20. $-8x + 8$ |
| 21. $-10y + 5$ | 22. $3x^2 - 2x - 8$ | 23. $2x^2 + 4x - 4$ | 24. $-x^2 - 18x + 15$ |

page 53 Exercise 11

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|-------|-------------------|-------|--------------------|-------------------|
| 1. 8 | 2. 9 | 3. 7 | 4. 10 | 5. $\frac{1}{3}$ |
| 6. 10 | 7. $1\frac{1}{2}$ | 8. -1 | 9. $-1\frac{1}{2}$ | 10. $\frac{1}{3}$ |

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|---------------------|----------------------|--------------------|---------------------|-----------------------|
| 11. 35 | 12. 130 | 13. 14 | 14. $\frac{2}{3}$ | 15. $3\frac{1}{3}$ |
| 16. $-2\frac{1}{2}$ | 17. 3 | 18. $1\frac{1}{8}$ | 19. $\frac{3}{10}$ | 20. $-1\frac{1}{4}$ |
| 21. 10 | 22. 27 | 23. 20 | 24. 18 | 25. 28 |
| 26. -15 | 27. $\frac{99}{100}$ | 28. 0 | 29. 1000 | 30. $-\frac{1}{1000}$ |
| 31. 1 | 32. -7 | 33. -5 | 34. $1\frac{1}{6}$ | 35. 1 |
| 36. 2 | 37. -5 | 38. -3 | 39. $-1\frac{1}{2}$ | 40. 2 |
| 41. 1 | 42. $3\frac{1}{2}$ | 43. 2 | 44. -1 | 45. $10\frac{2}{3}$ |
| 46. 1.1 | 47. -1 | 48. 2 | 49. $2\frac{1}{2}$ | 50. $1\frac{1}{3}$ |

page 54 Exercise 12

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|----------------------|--------------------|---------------------|---------------------|-------------------|----------------------|
| 1. $-1\frac{1}{2}$ | 2. 2 | 3. $-\frac{2}{5}$ | 4. $-\frac{1}{3}$ | 5. $1\frac{2}{3}$ | 6. 6 |
| 7. $-\frac{2}{3}$ | 8. $-3\frac{1}{5}$ | 9. $\frac{1}{2}$ | 10. -4 | 11. 18 | 12. 5 |
| 13. 4 | 14. 3 | 15. $2\frac{3}{4}$ | 16. $-\frac{7}{22}$ | 17. $\frac{1}{4}$ | 18. 1 |
| 19. 4 | 20. -11 | 21. $-7\frac{1}{3}$ | 22. $1\frac{1}{4}$ | 23. -5 | 24. 6 |
| 25. 3 | 26. 6 | 27. 2 | 28. 3 | 29. 4 | 30. 3 |
| 31. $10\frac{1}{2}$ | 32. 5 | 33. 2 | 34. -1 | 35. -17 | 36. $-2\frac{9}{10}$ |
| 37. $2\frac{10}{21}$ | 38. $\frac{1}{3}$ | 39. 14 | 40. 15 | | |

page 54 Exercise 13

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|--------------------|-------------------|--------------------|---------------------|----------------------|
| 1. $\frac{1}{4}$ | 2. -3 | 3. 4 | 4. $-7\frac{2}{3}$ | 5. -43 |
| 6. 11 | 7. $-\frac{1}{2}$ | 8. 0 | 9. 1 | 10. $-1\frac{2}{3}$ |
| 11. $\frac{1}{4}$ | 12. 0 | 13. $-\frac{6}{7}$ | 14. $1\frac{9}{17}$ | 15. $1\frac{22}{23}$ |
| 16. $\frac{2}{11}$ | 17. 4 cm | 18. 5 m | 19. 4 | |

page 56 Exercise 14

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|--------------------|---------------------|--------------------|--------------------|-------------------|--------|-------------------|--------------------|
| 1. $\frac{1}{3}$ | 2. $\frac{1}{5}$ | 3. $1\frac{2}{3}$ | 4. -3 | 5. $\frac{5}{11}$ | 6. -2 | 7. 6 | 8. $3\frac{3}{4}$ |
| 9. -7 | 10. $-7\frac{2}{3}$ | 11. 2 | 12. 3 | 13. 4 | 14. -2 | 15. -3 | 16. 3 |
| 17. $1\frac{5}{7}$ | 18. $4\frac{4}{5}$ | 19. 10 | 20. 24 | 21. 2 | 22. 3 | 23. 5 | 24. -4 |
| 25. $6\frac{3}{4}$ | 26. -3 | 27. 0 | 28. 3 | 29. 0 | 30. 1 | 31. 2 | 32. 3 |
| 33. 4 | 34. $\frac{3}{5}$ | 35. $1\frac{1}{8}$ | 36. -1 | 37. 1 | 38. 1 | 39. $\frac{1}{4}$ | 40. $-\frac{1}{3}$ |
| 41. $\frac{9}{10}$ | 42. 1 | 43. 2 | 44. $-\frac{1}{7}$ | 45. 2 | 46. 3 | | |

page 58 Exercise 15

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|--|--|---------------------------------------|---|
| 1. 91, 92, 93 | 2. 21, 22, 23, 24 | 3. 57, 59, 61 | 4. 506, 508, 510 |
| 5. $12\frac{1}{2}$ | 6. $12\frac{1}{2}$ | 7. $11\frac{2}{3}$ | 8. $8\frac{1}{3}$, $41\frac{2}{3}$ |
| 9. $1\frac{1}{4}$, $13\frac{3}{4}$ | 10. $3\frac{1}{3}$ cm | 11. 12 cm | 12. 20 |
| 13. 5 cm | 14. 7 cm | 15. $18\frac{1}{2}$, $27\frac{1}{2}$ | 16. 20° , 60° , 100° |
| 17. 45° , 60° , 75° | 18. 5 | 19. 6, 8 | 20. 12, 24, 30 |
| 21. 5, 15, 8 | 22. $59\frac{2}{3}$ kg, $64\frac{2}{3}$ kg, $72\frac{2}{3}$ kg | 26. 6 | 23. 24, 22, 15 |
| 24. 48, 12 | 25. 40, 8 | 30. \$21.50 | 27. 168.84 cm^2 |
| 28. 14 | 29. \$45, \$31 | | |

page 61 Exercise 16

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|------------|---------|---------------------|--------------------------|--|
| 1. \$3700 | 2. 3 | 3. $1\frac{3}{7}$ m | 4. $80^\circ, 100^\circ$ | 5. $30^\circ, 60^\circ, 90^\circ, 120^\circ, 150^\circ, 270^\circ$ |
| 6. 26, 58 | 7. 2 km | 8. 8 km | 9. 400 m | 10. 21 |
| 12. \$3600 | 13. 15 | 14. 2 km | 15. 7, 8, 9 | 11. 23 |
| | | | 16. 2, 3, 4, 5 | |

page 63 Exercise 17

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|---|---|------------------------------|-------------------------------|
| 1. $x = 2, y = 1$ | 2. $x = 4, y = 2$ | 3. $x = 3, y = 1$ | 4. $x = -2, y = 1$ |
| 5. $x = 3, y = 2$ | 6. $x = 5, y = -2$ | 7. $x = 2, y = 1$ | 8. $x = 5, y = 3$ |
| 9. $x = 3, y = -1$ | 10. $a = 2, b = -3$ | 11. $a = 5, b = \frac{1}{4}$ | 12. $a = 1, b = 3$ |
| 13. $m = \frac{1}{2}, n = 4$ | 14. $w = 2, x = 3$ | 15. $x = 6, y = 3$ | 16. $x = \frac{1}{2}, z = -3$ |
| 17. $m = 1\frac{15}{17}, n = \frac{11}{17}$ | 18. $c = 1\frac{16}{23}, d = -2\frac{12}{23}$ | | |

page 63 Exercise 18

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|----------|----------|-----------|-----------|----------|----------|
| 1. 1 | 2. -3 | 3. 2 | 4. 15 | 5. -12 | 6. -3 |
| 7. -2 | 8. -11 | 9. -21 | 10. 1 | 11. 0 | 12. 15 |
| 13. -10 | 14. 3 | 15. 6 | 16. -11 | 17. 2 | 18. 5 |
| 19. -19 | 20. -4 | 21. x | 22. $-3x$ | 23. $4x$ | 24. $4y$ |
| 25. $9y$ | 26. $3x$ | 27. $-8x$ | 28. $4x$ | 29. $2x$ | 30. $3y$ |

page 65 Exercise 19

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|---|----------------------|-------------------------------|--|
| 1. $x = 2, y = 4$ | 2. $x = 1, y = 4$ | 3. $x = 2, y = 5$ | 4. $x = 3, y = 7$ |
| 5. $x = 5, y = 2$ | 6. $a = 3, b = 1$ | 7. $x = 1, y = 3$ | 8. $x = 1, y = 3$ |
| 9. $x = -2, y = 3$ | 10. $x = 4, y = 1$ | 11. $x = 1, y = 5$ | 12. $x = 0, y = 2$ |
| 13. $x = \frac{5}{7}, y = 4\frac{3}{7}$ | 14. $x = 1, y = 2$ | 15. $x = 2, y = -3$ | 16. $x = 4, y = -1$ |
| 17. $x = 3, y = 1$ | 18. $x = 1, y = 2$ | 19. $x = 2, y = 1$ | 20. $x = -2, y = 1$ |
| 21. $x = 1, y = 2$ | 22. $a = 4, b = 3$ | 23. $x = -23, y = -78$ | 24. $x = 3, y = \frac{1}{2}$ |
| 25. $x = 4, y = 3$ | 26. $x = 5, y = -2$ | 27. $x = \frac{1}{3}, y = -2$ | 28. $x = 5\frac{5}{14}, y = \frac{2}{7}$ |
| 29. $x = 3, y = -1$ | 30. $x = 5, y = 0.2$ | | |

page 66 Exercise 20

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|----------------------------------|--|----------------------------------|---------------------------------|
| 1. $5\frac{1}{2}, 9\frac{1}{2}$ | 2. 6, 3 or $2\frac{2}{3}, 5\frac{2}{3}$ | 3. 4, 10 | 4. $a = 2, c = 7$ |
| 5. $m = 4, c = -3$ | 6. $a = 1, b = -2$ | 7. $m = 1c, w = 3c$ | 8. TV \$200, video \$450 |
| 9. 7, 3 | 10. white 2g, brown $3\frac{1}{2}$ g | 11. 120 cm, 240 cm | 12. 150 m 350 m |
| 13. $2c \times 15, 5c \times 25$ | 14. $10c \times 14, 50c \times 7$ | 15. 20 | |
| 16. man \$500, woman \$700 | | 17. current 4 m/s, kipper 10 m/s | |
| 18. $\frac{5}{7}$ | 19. $\frac{3}{5}$ | 20. boy 10, mouse 3 | 21. 4, 7 |
| 22. $y = 3x - 2$ | 23. walks 4 m/s, runs 5 m/s | | 24. \$1 \times 15, \$5 \times 5 |
| 25. 36, 9 | 26. wind $4\frac{1}{2}$ knots, submarine $20\frac{1}{2}$ knots | | 27. $a = 1, b = 2, c = 5$ |
| 28. $y = 2x^2 - 3x + 5$ | 29. $y = x^2 + 3x + 4$ | 30. $y = x^2 + 2x - 3$ | |

page 68 Exercise 21

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|-----------------------|--------------------------|-----------------------|-----------------------|
| 1. $x(x + 5)$ | 2. $x(x - 6)$ | 3. $x(7 - x)$ | 4. $y(y + 8)$ |
| 5. $y(2y + 3)$ | 6. $2y(3y - 2)$ | 7. $3x(x - 7)$ | 8. $2a(8 - a)$ |
| 9. $3c(2c - 7)$ | 10. $3x(5 - 3x)$ | 11. $7y(8 - 3y)$ | 12. $x(a + b + 2c)$ |
| 13. $x(x + y + 3z)$ | 14. $y(x^2 + y^2 + z^2)$ | 15. $ab(3a + 2b)$ | 16. $xy(x + y)$ |
| 17. $2a(3a + 2b + c)$ | 18. $m(a + 2b + m)$ | 19. $2k(x + 3y + 2z)$ | 20. $a(x^2 + y + 2b)$ |

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|-------------------|------------------|------------------|---------------------|
| 21. $xk(x+k)$ | 22. $ab(a^2+2b)$ | 23. $bc(a-3b)$ | 24. $ae(2a-5e)$ |
| 25. $ab(a^2+b^2)$ | 26. $x^2y(x+y)$ | 27. $2xy(3y-2x)$ | 28. $3ab(b^2-a^2)$ |
| 29. $a^2b(2a+5b)$ | 30. $ax^2(y-2z)$ | 31. $2ab(x+b+a)$ | 32. $yx(a+x^2-2yx)$ |

page 69 Exercise 22

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|--------------------|-------------------|--------------------|---------------------|
| 1. $(a+b)(x+y)$ | 2. $(a+b)(y+z)$ | 3. $(x+y)(b+c)$ | 4. $(x+y)(h+k)$ |
| 5. $(x+y)(m+n)$ | 6. $(a+b)(h-k)$ | 7. $(a+b)(x-y)$ | 8. $(m+n)(a-b)$ |
| 9. $(h+k)(s+t)$ | 10. $(x+y)(s-t)$ | 11. $(a-b)(x-y)$ | 12. $(x-y)(s-t)$ |
| 13. $(a-x)(s-y)$ | 14. $(h-b)(x-y)$ | 15. $(m-n)(a-b)$ | 16. $(x-z)(k-m)$ |
| 17. $(2a+b)(x+3y)$ | 18. $(2a+b)(x+y)$ | 19. $(2m+n)(h-k)$ | 20. $(m-n)(2h+3k)$ |
| 21. $(2x+y)(3a+b)$ | 22. $(2a-b)(x-y)$ | 23. $(x^2+y)(a+b)$ | 24. $(m-n)(s+2t^2)$ |

page 69 Exercise 23

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|--------------------|--------------------|-------------------|------------------|
| 1. $(x+2)(x+5)$ | 2. $(x+3)(x+4)$ | 3. $(x+3)(x+5)$ | 4. $(x+3)(x+7)$ |
| 5. $(x+2)(x+6)$ | 6. $(y+5)(y+7)$ | 7. $(y+3)(y+8)$ | 8. $(y+5)(y+5)$ |
| 9. $(y+3)(y+12)$ | 10. $(a+2)(a-5)$ | 11. $(a+3)(a-4)$ | 12. $(z+3)(z-2)$ |
| 13. $(x+5)(x-7)$ | 14. $(x+3)(x-8)$ | 15. $(x-2)(x-4)$ | 16. $(y-2)(y-3)$ |
| 17. $(x-3)(x-5)$ | 18. $(a+2)(a-3)$ | 19. $(a+5)(a+9)$ | 20. $(b+3)(b-7)$ |
| 21. $(x-4)(x-4)$ | 22. $(y+1)(y+1)$ | 23. $(y-7)(y+4)$ | 24. $(x-5)(x+4)$ |
| 25. $(x-20)(x+12)$ | 26. $(x-15)(x-11)$ | 27. $(y+12)(y-9)$ | 28. $(x-7)(x+7)$ |
| 29. $(x-3)(x+3)$ | 30. $(x-4)(x+4)$ | | |

page 70 Exercise 24

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|--------------------|--------------------|---------------------|---------------------|
| 1. $(2x+3)(x+1)$ | 2. $(2x+1)(x+3)$ | 3. $(3x+1)(x+2)$ | 4. $(2x+3)(x+4)$ |
| 5. $(3x+2)(x+2)$ | 6. $(2x+5)(x+1)$ | 7. $(3x+1)(x-2)$ | 8. $(2x+5)(x-3)$ |
| 9. $(2x+7)(x-3)$ | 10. $(3x+4)(x-7)$ | 11. $(2x+1)(3x+2)$ | 12. $(3x+2)(4x+5)$ |
| 13. $(3x-2)(x-3)$ | 14. $(y-2)(3y-5)$ | 15. $(4y-3)(y-5)$ | 16. $(2y+3)(3y-1)$ |
| 17. $(2x-5)(3x-6)$ | 18. $(5x+2)(2x+1)$ | 19. $(6x-1)(x-3)$ | 20. $(4x+1)(2x-3)$ |
| 21. $(6x+5)(2x-1)$ | 22. $(16x+3)(x+1)$ | 23. $(2a-1)(2a-1)$ | 24. $(x+2)(12x-7)$ |
| 25. $(x+3)(15x-1)$ | 26. $(8x+1)(6x+5)$ | 27. $(16y-3)(4y+1)$ | 28. $(15x-1)(8x+5)$ |
| 29. $(3x-1)(3x+1)$ | 30. $(2a-3)(2a+3)$ | | |

page 70 Exercise 25

- | | | | |
|---|--|--|--|
| 1. $(y-a)(y+a)$ | 2. $(m-n)(m+n)$ | 3. $(x-t)(x+t)$ | 4. $(y-1)(y+1)$ |
| 5. $(x-3)(x+3)$ | 6. $(a-5)(a+5)$ | 7. $(x-\frac{1}{2})(x+\frac{1}{2})$ | 8. $(x-\frac{1}{3})(x+\frac{1}{3})$ |
| 9. $(2x-y)(2x+y)$ | 10. $(a-2b)(a+2b)$ | 11. $(5x-2y)(5x+2y)$ | 12. $(3x-4y)(3x+4y)$ |
| 13. $\left(x-\frac{y}{2}\right)\left(x+\frac{y}{2}\right)$ | 14. $\left(3m-\frac{2}{3}n\right)\left(3m+\frac{2}{3}n\right)$ | 15. $\left(4t-\frac{2}{5}s\right)\left(4t+\frac{2}{5}s\right)$ | 16. $\left(2x-\frac{z}{10}\right)\left(2x+\frac{z}{10}\right)$ |
| 17. $x(x-1)(x+1)$ | 18. $a(a-b)(a+b)$ | 19. $x(2x-1)(2x+1)$ | |
| 20. $2x(2x-y)(2x+y)$ | 21. $3x(2x-y)(2x+y)$ | 22. $2m(3m-2n)(3m+2n)$ | |
| 23. $5\left(x-\frac{1}{2}\right)\left(x+\frac{1}{2}\right)$ | 24. $2a(5a-3b)(5a+3b)$ | 25. $3y(2x-z)(2x+z)$ | |
| 26. $4ab(3a-b)(3a+b)$ | 27. $2a^3(5a-2b)(5a+2b)$ | 28. $9xy(2x-5y)(2x+5y)$ | |
| 29. 161 | 30. 404 | 31. 4400 | 32. 2421 |
| 34. 0.75 | 35. 4.8 | 36. -2469 | 37. 0.0761 |
| 38. -10 900 | 39. 53.6 | 40. 0.000 005 | 33. 4329 |

page 71 Exercise 26

- | | | | | |
|------------------------|-----------------------------------|------------------------------------|------------------------------------|------------------------------------|
| 1. -3, -4 | 2. -2, -5 | 3. 3, -5 | 4. 2, -3 | 5. 2, 6 |
| 6. -3, -7 | 7. 6, -1 | 8. 5, -1 | 9. -7, 2 | 10. $-\frac{1}{2}$, 2 |
| 11. $\frac{2}{3}$, -4 | 12. $1\frac{1}{2}$, -5 | 13. $\frac{2}{3}$, $1\frac{1}{2}$ | 14. $\frac{1}{4}$, 7 | 15. $\frac{3}{5}$, $-\frac{1}{2}$ |
| 16. 7, 8 | 17. $\frac{5}{6}$, $\frac{1}{2}$ | 18. 7, -9 | 19. -1, -1 | 20. 3, 3 |
| 21. -5, -5 | 22. 7, 7 | 23. $-\frac{1}{3}$, $\frac{1}{2}$ | 24. $-1\frac{1}{4}$, 2 | 25. 13, -5 |
| 26. -3, $\frac{1}{6}$ | 27. $\frac{1}{10}$, -2 | 28. 1, 1 | 29. $\frac{2}{9}$, $-\frac{1}{4}$ | 30. $-\frac{1}{4}$, $\frac{3}{5}$ |

page 72 Exercise 27

- | | | | | |
|------------------------------------|------------------------------------|--------------------------------------|------------------------------------|-----------------------|
| 1. 0, 3 | 2. 0, -7 | 3. 0, 1 | 4. 0, $\frac{1}{3}$ | 5. 4, -4 |
| 6. 7, -7 | 7. $\frac{1}{2}$, $-\frac{1}{2}$ | 8. $\frac{2}{3}$, $-\frac{2}{3}$ | 9. 0, $-1\frac{1}{2}$ | 10. 0, $1\frac{1}{2}$ |
| 11. 0, $5\frac{1}{2}$ | 12. $\frac{1}{4}$, $-\frac{1}{4}$ | 13. $\frac{1}{2}$, $-\frac{1}{2}$ | 14. 0, $\frac{5}{8}$ | 15. 0, $\frac{1}{12}$ |
| 16. 0, 6 | 17. 0, 11 | 18. 0, $1\frac{1}{2}$ | 19. 0, 1 | 20. 0, 4 |
| 21. 0, 3 | 22. $\frac{1}{2}$, $-\frac{1}{2}$ | 23. $1\frac{1}{3}$, $-1\frac{1}{3}$ | 24. 3, -3 | 25. 0, $2\frac{2}{5}$ |
| 26. $\frac{1}{3}$, $-\frac{1}{3}$ | 27. 0, $\frac{1}{4}$ | 28. 0, $\frac{1}{6}$ | 29. $\frac{1}{4}$, $-\frac{1}{4}$ | 30. 0, $\frac{1}{5}$ |

page 73 Exercise 28

- | | | | |
|-------------------------------------|--------------------------------------|------------------------------------|-------------------------------------|
| 1. $-\frac{1}{2}$, -5 | 2. $-\frac{2}{3}$, -3 | 3. $-\frac{1}{2}$, $-\frac{2}{3}$ | 4. $\frac{1}{3}$, 3 |
| 5. $\frac{2}{5}$, 1 | 6. $\frac{1}{3}$, $1\frac{1}{2}$ | 7. -0.63, -2.37 | 8. -0.27, -3.73 |
| 9. 0.72, 0.28 | 10. 6.70, 0.30 | 11. 0.19, -2.69 | 12. 0.85, -1.18 |
| 13. 0.61, -3.28 | 14. $-1\frac{2}{3}$, 4 | 15. $-1\frac{1}{2}$, 5 | 16. 3.56, -0.56 |
| 17. 0.16, -3.16 | 18. $-\frac{1}{2}$, $2\frac{1}{3}$ | 19. $-\frac{1}{3}$, -8 | 20. $1\frac{2}{3}$, -1 |
| 21. 2.28, 0.22 | 22. -0.35, -5.65 | 23. $-\frac{2}{3}$, $\frac{1}{2}$ | 24. -0.58, 2.58 |
| 25. -2.69, 0.19 | 26. 0.22, -1.55 | 27. -0.37, 5.37 | 28. $-\frac{5}{6}$, $1\frac{3}{4}$ |
| 29. $-\frac{7}{9}$, $1\frac{1}{4}$ | 30. $1\frac{2}{5}$, $-2\frac{1}{4}$ | 31. -4, $1\frac{1}{2}$ | 32. -3, $1\frac{2}{3}$ |
| 33. -2, $1\frac{2}{3}$ | 34. $-3\frac{1}{2}$, $\frac{1}{5}$ | 35. -3, $\frac{4}{5}$ | 36. $-8\frac{1}{2}$, 11 |

page 74 Exercise 29

- | | | | | |
|------------------------------------|-----------------|------------------------|------------------------------------|------------------------------------|
| 1. -3, 2 | 2. -3, -7 | 3. $-\frac{1}{2}$, 2 | 4. 1, 4 | 5. $-1\frac{2}{3}$, $\frac{1}{2}$ |
| 6. -0.39, -4.28 | 7. -0.16, 6.16 | 8. 3 | 9. 2, $-1\frac{1}{3}$ | 10. -3, -1 |
| 11. 0.66, -22.66 | 12. -7, 2 | 13. $\frac{1}{4}$, 7 | 14. $-\frac{1}{2}$, $\frac{3}{5}$ | 15. 0, $3\frac{1}{2}$ |
| 16. $-\frac{1}{4}$, $\frac{1}{4}$ | 17. -2.77, 1.27 | 18. $-\frac{2}{3}$, 1 | 19. $-\frac{1}{2}$, 2 | 20. 0, 3 |
| 21. (a) -1 | (b) 0.6258 | (c) 0.5961 | (d) 0.2210 | |

page 76 Exercise 30

- | | | | | |
|--------------------|-------------------------|---------------------------|---|-------------|
| 1. 8, 11 | 2. 11, 13 | 3. 12 cm | 4. 6 cm | |
| 5. $x = 11$ | 6. 10 cm \times 24 cm | 7. 8 km north, 15 km east | 8. 12 eggs | |
| 9. 13 eggs | 10. 4 or -1 | 11. 2, 5 | 12. $\frac{40}{x}$ h, $\frac{40}{x-2}$ h, 10 km/h | |
| 13. 4 km/h | 14. 60 km/h | 15. 5 km/h | 16. 157 km | 17. $x = 2$ |
| 18. $x = 3$ or 9.5 | 19. $\frac{3}{4}$ | 20. 9 cm or 13 cm | | |

page 77 Revision exercise 2A

1. (a) $-2\frac{1}{2}$ (b) $2\frac{2}{3}$ (c) 0, -5 (d) 2, -2 (e) $-5, 2\frac{2}{3}$
2. (a) 14 (b) 18 (c) 28
3. (a) $(2x - y)(2x + y)$ (b) $2(x + 3)(x + 1)$ (c) $(2 - 3k)(3m + 2n)$ (d) $(2x + 1)(x - 3)$
4. (a) $x = 3, y = -2$ (b) $m = 1\frac{1}{2}, n = -3$ (c) $x = 7, y = \frac{1}{2}$ (d) $x = -1, y = -2$
5. (a) 8 (b) 140 (c) 29 (d) 42 (e) 6 (f) -6
6. (a) $2x - 21$ (b) $(1 - 2x)(2a - 3b)$ (c) 23
7. (a) 1 (b) $10\frac{1}{2}$ (c) 0, $3\frac{1}{2}$ (d) -3, -2 (e) 12
8. (a) $z(z - 4)(z + 4)$ (b) $(x^2 + 1)(y^2 + 1)$ (c) $(2x + 3)(x + 4)$ 9. $\frac{7}{8}$
10. (a) $c = 5, d = -2$ (b) $x = 2, y = -1$ (c) $x = 9, y = -14$ (d) $s = 5, t = -3$
11. (a) $\frac{1}{2}, -\frac{1}{2}$ (b) $\frac{7}{11}$ (c) 3 (d) 0, 5
12. (a) 1.78, -0.28 (b) 1.62, -0.62 (c) 0.87, -1.54 (d) 1.54, -4.54
13. (a) $x = 9$ (b) $x = 10$
14. (a) 2 (b) -3 (c) 36 (d) 0 (e) 36 (f) 4
15. speed = 5 km/h 16. $8\text{ cm} \times 6.5\text{ cm}$ 17. (a) -2, 4 (b) 16 (c) 6.19, 0.81
18. $-\frac{1}{5}, 3$ 19. 8 20. $x = 13$ 21. 21
22. 18 23. 6 cm 24. -4

page 80 Examination exercise 2B

1. (a) $x^2 - (x - 4)^2 = 112$ (b) 16 2. (a) 1070.58 (b) $r = \frac{100}{P}(A - P)$
3. (a) $x + 3, (x + 3)^2$ (b) (i) $x + (x + 3) + (x + 3)^2 = 77$ (iii) $x = 5$ or -13 (iv) 5, 8, 64
4. (a) 338 350 (b) (i) 50 (ii) 171 700 (c) 166 650 (d) -5500
5. (a) $\frac{x+5}{6}$ (b) (i) $(x - 2)(x - 3)$ (ii) $\frac{x-3}{x+3}$ (c) 0.15 or 2.18
6. (a) (i) $\frac{13}{21}, \frac{21}{34}$ (ii) $\frac{a+2b}{2a+3b}, \frac{2a+3b}{3a+5b}$ (b) (i) $\frac{5}{x+4}, \frac{6}{x+5}$ (ii) $\frac{100}{x+99}$ (iii) 11
7. (a) (i) $x(x - 1)(x + 1) = 40(3x)$ (b) $x(x - 11)(x + 11)$ (c) 10, 11, 12
8. (a) $\frac{200}{x(x - 2)}$ (b) $\frac{100}{x}$ (c) $\frac{100}{x - 2} - \frac{100}{x} = 5$ (d) (i) 7.40 or -5.40 (ii) 7.40 francs

3 Mensuration

page 83 Exercise 1

1. 10.2 m^2 2. 22 cm^2 3. 103 m^2 4. 9 cm^2
5. 31 m^2 6. 6000 cm^2 or 0.6 m^2 7. 26 m^2 8. 18 cm^2
9. 20 cm^2 10. 13 m 11. 15 cm 12. 56 m
13. 8 m, 10 m 14. 12 cm 15. 2500 16. 6 square units
17. 14 square units 18. 1849 20. 1100 m

page 85 Exercise 2

1. 48.3 cm^2 2. 28.4 cm^2 3. 66.4 m^2 4. 3.1 cm^2
5. 18.2 cm^2 6. 12.3 cm^2 7. 2.78 cm^2 8. 36.4 m^2
9. 62.4 m^2 10. 30.4 m^2 11. 44.9 cm^2 12. 0.28 m^2
13. 63 m^2 14. 70.7 m^2 15. 14 m^2 16. 65.8 cm^2

17. 18.1 cm^2 18. 8.0 m^2 19. 14 m^2 20. 52.0 cm^2
 21. 124 cm^2 22. 69.8 m^2 23. 57.1 cm^2 24. 10.7 cm
 25. 50.9° 26. 4.10 m 27. 4.85 m 28. 7.23 cm
 29. 60° ; 23.4 cm^2 30. 292 31. 110 cm^2
 32. (a) $\frac{360^\circ}{n}$ (b) $\frac{n}{2} \sin \frac{360^\circ}{n}$ (c) 2.6, 2.94, 3.1414, 3.1416, 3.1416 as n increases, $A \rightarrow \pi$ 33. 18.7 cm

page 88 Exercise 3

1. (a) 31.4 cm (b) 78.5 cm^2 2. (a) 18.8 cm (b) 28.3 cm^2
 3. (a) 51.4 cm (b) 157 cm^2 4. (a) 26.6 cm (b) 49.1 cm^2
 5. (a) 26.3 cm (b) 33.3 cm^2 6. (a) 25.0 cm (b) 38.5 cm^2
 7. (a) 35.7 cm (b) 21.5 cm^2 8. (a) 50.3 cm (b) 174 cm^2
 9. (a) 22.0 cm (b) 10.5 cm^2 10. (a) 9.42 cm (b) 6.44 cm^2
 11. (a) 25.1 cm (b) 25.1 cm^2 12. (a) 18.8 cm (b) 12.6 cm^2

page 89 Exercise 4

1. 2.19 cm 2. 30.2 m 3. 2.65 km 4. 9.33 cm
 5. 14.2 mm 6. $497\,000 \text{ km}^2$ 7. 21.5 cm^2
 8. (a) 40.8 m^2 (b) 6 9. (a) 30; (b) 1508 cm^2 (c) 508 cm^2
 10. 5305 11. 29 12. 970 13. (a) 80 (b) 7
 14. 5.39 cm ($\sqrt{39}$) 15. (a) 33.0 cm (b) 70.9 cm^2 16. (a) 98 cm^2 (b) 14.0 cm^2
 17. $1:3:5$ 18. 796 m^2 19. 57.5° 20. Yes 21. 1.716 cm

page 93 Exercise 5

1. (a) 2.09 cm ; 4.19 cm^2 (b) 7.85 cm ; 39.3 cm^2 (c) 8.20 cm ; 8.20 cm^2
 2. 31.9 cm^2 3. 31.2 cm^2
 4. (a) 7.07 cm^2 (b) 19.5 cm^2 5. (a) 85.9° (b) 57.3° (c) 6.25 cm
 6. (a) 12 cm (b) 30° 7. (a) 3.98 cm (b) 74.9°
 8. (a) 30° (b) 10.5 cm 9. (a) 18 cm (b) 38.2°
 10. (a) 10 cm (b) 43.0° 11. (a) 6.14 cm (b) 27.6 m (c) 28.6 cm^2
 12. 14.8 km^2

page 96 Exercise 6

1. (a) 14.5 cm (b) 72.6 cm^2 (c) 24.5 cm^2 (d) 48.1 cm^2
 2. (a) 5.08 cm^2 (b) 82.8 m^2 (c) 5.14 cm^2
 3. (a) 60° , 9.06 cm^2 (b) 106.3° , 11.2 cm^2
 4. 3 cm 5. 3.97 cm 6. 13.5 cm^2 , 405 cm^3 7. 63.6 cm^2 ; 250.5 cm^2
 8. 459 cm^2 , 651 cm^2 9. 19.6 cm^2 10. $0.313r^2$
 11. (a) 8.37 cm (b) 54.5 cm (c) 10.4 cm 12. 81.2 cm^2

page 98 Exercise 7

1. (a) 30 cm^3 (b) 168 cm^3 (c) 110 cm^3 (d) 94.5 cm^3 (e) 754 cm^3 (f) 283 cm^3
 2. (a) 503 cm^3 (b) 760 m^3 (c) 12.5 cm^3
 3. 3.98 cm 4. 6.37 cm 5. 1.89 cm 6. 5.37 cm
 7. 9.77 cm 8. 7.38 cm 9. 12.7 m 10. 4.24 litres
 11. 106 cm/s 12. 1570 cm^3 , 12.6 kg 13. $3:4$ 14. cubes by 77 cm^3
 15. No 16. 1.19 cm 17. 53 times 18. 191 cm

page 101 Exercise 8

- | | | | | | |
|---------------------------|-------------------------|---------------------------|-------------------------|----------------------------------|------------------------------------|
| 1. 20.9 cm^3 | 2. 524 cm^3 | 3. 4189 cm^3 | 4. 101 cm^3 | 5. 268 cm^3 | 6. $4.19 \times 10^3 \text{ cm}^3$ |
| 7. 0.00419 m^3 | 8. 3 cm^3 | 9. 93.3 cm^3 | 10. 48 cm^3 | 11. 92.4 cm^3 | 12. 262 cm^3 |
| 13. 235 cm^3 | 14. 415 cm^3 | 15. 5 m | 16. 2.43 cm | 17. 23.9 cm | 18. 6 cm |
| 19. 3.72 cm | 20. 1.93 kg | 21. 106 s | 22. (a) 125 | (b) 2744 | (c) 2.7×10^7 |
| 23. (a) 0.36 cm | (b) 0.427 cm | 24. (a) 6.69 cm | (b) 39.1 cm | 25. $10\frac{2}{3} \text{ cm}^3$ | 26. 1.05 cm^3 |
| 27. 488 cm^3 | 28. 4 cm | 29. 53.6 cm^3 | 30. 74.5 cm^3 | 31. 4.24 cm | 32. 123 cm^3 |
| 33. 54.5 litres | 34. (a) 16π | (b) 8 cm | (c) 6 cm | 35. 471 cm^3 | 36. 2720 cm^3 |
| 37. 943 cm^3 | 38. 5050 cm^3 | | | | |

page 105 Exercise 9

- | | | | |
|------------------------------------|---|--------------------------------------|----------------------------|
| 1. (a) $36\pi \text{ cm}^2$ | (b) $72\pi \text{ cm}^2$ | (c) $60\pi \text{ cm}^2$ | (d) $2.38\pi \text{ m}^2$ |
| (e) $400\pi \text{ m}^2$ | (f) $65\pi \text{ cm}^2$ | (g) $192\pi \text{ mm}^2$ | (h) $10.2\pi \text{ cm}^2$ |
| (i) $0.0004\pi \text{ m}^2$ | (j) $98\pi \text{ cm}^2, 147\pi \text{ cm}^2$ | | |
| 2. 1.64 cm | 3. 2.12 cm | 4. 3.46 cm | |
| 5. (a) 3 cm | (b) 4 cm | (c) 5 cm | (d) 0.2 m |
| (e) 6 cm | (f) 0.25 cm | (g) 7 m | |
| 6. 303 cm^2 | 7. $\$1178$ | 8. $\$3870$ | 9. 94.0 cm^3 |
| 10. 44.6 cm^2 | 11. 675 cm^2 | 12. $1.62 \times 10^8 \text{ years}$ | 13. 377 cm^2 |
| 14. $20 \text{ cm}, 10 \text{ cm}$ | 15. 71.7 cm^2 | 16. 147 cm^2 | |

page 107 Revision exercise 3A

- | | | | |
|--|-------------------------|---|-------------------------|
| 1. (a) 14 cm^2 | (b) 54 cm^2 | (c) 50 cm^2 | (d) 18 m^2 |
| 2. (a) $56.5 \text{ m}, 254 \text{ m}^2$ | (b) 10.8 cm | (c) 3.99 cm | |
| 3. (a) $9\pi \text{ cm}^2$ | (b) $8:1$ | 4. $3.43 \text{ cm}^2, 4.57 \text{ cm}^2$ | |
| 5. (a) 12.2 cm | (b) 61.1 cm^2 | | |
| 6. (a) 11.2 cm | (b) 10.3 cm | (c) 44.7 cm^2 | (d) 31.5 cm^2 |
| 7. 103.1° | 8. 9.95 cm | 9. (a) 905 cm^3 | (b) 5.76 cm |
| 10. 8.06 cm | 11. 99.5 cm^3 | 12. $333 \text{ cm}^3, 201 \text{ cm}^3$ | 13. 4 cm |
| 14. (a) 15.6 cm^2 | (b) 93.5 cm^2 | (c) 3741 cm^2 | |
| 15. 0.370 cm | 16. 104 cm^2 | 17. 5.14 cm^2 | 18. 68c |
| | | 19. 25 | 20. 20 cm^2 |

page 110 Examination exercise 3B

- | | | | | |
|---------------------------------|----------------------------|----------------------------|-------------------------------|-------------------------|
| 1. (a) 11.2 cm | (b) 68° | (c) 11.9 cm | 2. (a) 67.4° | (b) 204 cm^2 |
| 3. (b) (i) 1.35 cm | (ii) 1.30 cm | (iii) 0.880 cm^2 | (iv) 6.16 cm^2 | (c) 1.85 cm^3 |
| 4. (a) (ii) 9.4 cm | (iii) 9.42 cm | (b) (i) 5.77 cm | (ii) 24.23 | (iii) 31.4 |
| (iv) 31.4 | (c) $\approx \text{equal}$ | | | |
| 5. (a) (ii) 8.38 cm^2 | (iii) 6.93 cm^2 | (iv) 1.45 cm^2 | (b) (ii) 0.542 cm^2 | (c) 1.99 cm^2 |
| 6. (a) 332.5 m^2 | (b) 598.5 tonnes | (c) 29.5% | (d) $565\,000 \text{ l}$ | |
| 7. (b) (i) 905 cm^3 | (ii) 147 cm^3 | (iii) 83.8% | (c) (i) 37.7 cm | (ii) 7 |
| | (iii) 15.2° | | | |

4 Geometry

page 115 Exercise 1

- | | | | | | | |
|--|-----------------------------------|--------------------|--------------------|---|---------------|-------------------|
| 1. 95° | 2. 49° | 3. 100° | 4. 77° | 5. 129° | 6. 95° | 7. $a = 30^\circ$ |
| 8. $e = 30^\circ, f = 60^\circ$ | 9. 110° | 10. $x = 54^\circ$ | 11. $a = 40^\circ$ | | | |
| 12. $a = 36^\circ, b = 72^\circ, c = 144^\circ, d = 108^\circ$ | | | | 13. 105° | | |
| 14. $a = 30^\circ, b = 120^\circ, c = 150^\circ$ | 15. $x = 20^\circ, y = 140^\circ$ | | | 16. $a = 120^\circ, b = 34^\circ, c = 26^\circ$ | | |

17. $a = 68^\circ$, $b = 58.5^\circ$ 18. 25° 19. 44°
 20. $a = 30^\circ$, $b = 60^\circ$, $c = 150^\circ$, $d = 120^\circ$ 21. $a = 10^\circ$, $b = 76^\circ$
 22. $e = 71^\circ$, $f = 21^\circ$ 23. 144° 24. 70°
 25. 41° , 66° 26. 46° , 122° 27. 36°

page 117 Exercise 2

1. $a = 72^\circ$, $b = 108^\circ$ 2. $x = 60^\circ$, $y = 120^\circ$ 3. $(n - 2)180^\circ$ 4. 110°
 5. 60° 6. $128\frac{4}{7}^\circ$ 7. 15 8. 12
 9. 9 10. 18 11. 12 12. 36°

page 119 Exercise 3

1. $a = 116^\circ$, $b = 64^\circ$, $c = 64^\circ$ 2. $a = 64^\circ$, $b = 40^\circ$ 3. $x = 68^\circ$
 4. $a = 40^\circ$, $b = 134^\circ$, $c = 134^\circ$ 5. $m = 69^\circ$, $y = 65^\circ$
 6. $t = 48^\circ$, $u = 48^\circ$, $v = 42^\circ$ 7. $a = 118^\circ$, $b = 100^\circ$, $c = 62^\circ$
 8. $a = 34^\circ$, $b = 76^\circ$, $c = 70^\circ$, $d = 70^\circ$ 9. 72° , 108°

page 120 Exercise 4

1. 10 cm 2. 4.12 cm 3. 4.24 cm 4. 12.7 cm 5. 8.72 cm 6. 5.66 cm
 7. 6.63 cm 8. 5 cm 9. 17 cm 10. 4 cm 11. 9.85 cm 12. 7.07 cm
 13. 3.46 m 14. 40.3 km 15. 13.6 cm 16. 6.34 m 17. 4.58 cm 18. 84.9 km
 19. 24 cm 20. 9.80 cm 21. 5, 4, 3; 13, 12, 5; 25, 24, 7; 41, 40, 9; 61, 60, 11
 22. $x = 4$ m, 20.6 m 23. 9.49 cm 24. 18.5 km

page 123 Exercise 5

1. (a) 1, 1 (b) 1, 1 (c) 2, 2 (d) 2, 2 (e) 4, 4 (f) 0, 2 (g) 5, 5
 (h) 0, 1 (i) 1, 1 (j) 0, 2 (k) 0, 2 (l) 0, 2 (m) ∞ , ∞ (n) 0, 4
 4. square 4, 4; rectangle 2, 2; parallelogram 0, 2; rhombus 2, 2; trapezium 0, 1; kite 1, 1;
 equilateral triangle 3, 3; regular hexagon 6, 6
 5. 34° , 56° 6. 35° , 35° 7. 72° , 108° , 80° 8. 40° , 30° , 110° 9. 116° , 32° , 58°
 10. 55° , 55° 11. 26° , 26° , 77° 12. 52° , 64° , 116° 13. 70° , 40° , 110° 14. 54° , 72° , 36°
 15. 60° , 15° , 75° , 135°

page 125 Exercise 6

1. $a = 2\frac{1}{2}$ cm, $e = 3$ cm 2. $x = 6$ cm, $y = 10$ cm 3. $x = 12$ cm, $y = 8$ cm
 4. $m = 10$ cm, $a = 16\frac{2}{3}$ cm 5. $y = 6$ cm 6. $x = 4$ cm, $w = 1\frac{1}{2}$ cm
 7. $e = 9$ cm, $f = 4\frac{1}{2}$ cm 8. $x = 13\frac{1}{3}$ cm, $y = 9$ cm 9. $m = 6$ cm, $n = 6$ cm
 10. $m = 5\frac{1}{3}$ cm, $z = 4\frac{4}{5}$ cm 11. $v = 5\frac{1}{3}$ cm, $w = 6\frac{2}{3}$ cm 12. No
 13. 2 cm, 6 cm 14. 16 m
 15. (a) Yes (b) No (c) No (d) Yes (e) Yes (f) No (g) No (h) Yes
 18. 0.618; 1.618 : 1

page 127 Exercise 7

1. A and G; B and E.

page 129 Exercise 8

1. 16 cm^2 2. 27 cm^2 3. $11\frac{1}{4}\text{ cm}^2$ 4. $14\frac{1}{2}\text{ cm}^2$ 5. 128 cm^2 6. 12 cm^2
 7. 8 cm 8. 18 cm 9. $4\frac{1}{2}\text{ cm}$ 10. $7\frac{1}{2}\text{ cm}$ 11. $2\frac{1}{2}\text{ cm}$ 12. 6 cm

13. (a) $16\frac{2}{3} \text{ cm}^2$ (b) $10\frac{2}{3} \text{ cm}^2$ 14. (a) 25 cm^2 (b) 21 cm^2
 15. 8 cm^2 16. 6 cm 17. 24 cm^2
 18. (a) $1\frac{4}{5} \text{ cm}$ (b) 3 cm (c) $3 : 5$ (d) $9 : 25$
 19. 150 20. 360 21. Less (for the same weight)

page 132 Exercise 9

1. 480 cm^3 2. 540 cm^3 3. 160 cm^3 4. 4500 cm^3 5. 81 cm^3
 6. 11 cm^3 7. 16 cm^3 8. $85\frac{1}{3} \text{ cm}^3$ 9. 4 cm 10. 21 cm
 11. 4.6 cm 12. 9 cm 13. 6.6 cm 14. $4\frac{1}{2} \text{ cm}$ 15. $168\frac{3}{4} \text{ cm}^3$
 16. 106.3 cm^3 17. 12 cm 18. (a) $2 : 3$ (b) $8 : 27$ 19. $8 : 125$
 20. $x_1^3 : x_2^3$ 21. 54 kg 22. 240 cm^2 23. $9\frac{3}{8} \text{ litres}$ 24. $2812\frac{1}{2} \text{ cm}^2$

page 135 Exercise 10

1. $a = 27^\circ, b = 30^\circ$ 2. $c = 20^\circ, d = 45^\circ$ 3. $c = 58^\circ, d = 41^\circ, e = 30^\circ$
 4. $f = 40^\circ, g = 55^\circ, h = 55^\circ$ 5. $a = 32^\circ, b = 80^\circ, c = 43^\circ$ 6. $x = 34^\circ, y = 34^\circ, z = 56^\circ$
 7. 43° 8. 92° 9. 42°
 10. $c = 46^\circ, d = 44^\circ$ 11. $e = 49^\circ, f = 41^\circ$ 12. $g = 76^\circ, h = 52^\circ$
 13. 48° 14. 32° 15. 22°
 16. $a = 36^\circ, x = 36^\circ$

page 137 Exercise 11

1. $a = 94^\circ, b = 75^\circ$ 2. $c = 101^\circ, d = 84^\circ$ 3. $x = 92^\circ, y = 116^\circ$
 4. $c = 60^\circ, d = 45^\circ$ 5. 37° 6. 118°
 7. $e = 36^\circ, f = 72^\circ$ 8. 35° 9. 18°
 10. 90° 11. 30° 12. $22\frac{1}{2}^\circ$
 13. $n = 58^\circ, t = 64^\circ, w = 45^\circ$ 14. $a = 32^\circ, b = 40^\circ, c = 40^\circ$ 15. $a = 18^\circ, c = 72^\circ$
 16. 55° 17. $e = 41^\circ, f = 41^\circ, g = 41^\circ$ 18. 8°
 19. $x = 30^\circ, y = 115^\circ$ 20. $x = 80^\circ, z = 10^\circ$

page 139 Exercise 12

1. $a = 18^\circ$ 2. $x = 40^\circ, y = 65^\circ, z = 25^\circ$
 3. $c = 30^\circ, e = 15^\circ$ 4. $f = 50^\circ, g = 40^\circ$
 5. $h = 70^\circ, k = 40^\circ, i = 40^\circ$ 6. $m = 108^\circ, n = 36^\circ$
 7. $x = 50^\circ, y = 68^\circ$ 8. $a = 74^\circ, b = 32^\circ$
 9. $e = 36^\circ$ 10. $k = 63^\circ, m = 54^\circ$
 11. $k = 50^\circ, m = 50^\circ, n = 80^\circ, p = 80^\circ$ 12. $n = 16^\circ, p = 46^\circ$
 13. (a) 24° (b) 78° (c) 48° 14. (a) p (b) $2p$ (c) $90 - 2p$
 15. $x = 70^\circ, y = 20^\circ, z = 55^\circ$ 16. (b) $2a, 180 - 3a$
 19. $55^\circ, 60^\circ, 65^\circ$ 20. (a) 64° (b) $180 - 2x$

page 142 Exercise 13

1. 93° 2. 36°
 7. 7.8 cm
 8. (a) 7.2 cm (b) 5.2 cm (c) 12.2 cm (d) 8.2 cm
 9. 10.4 cm 10. 3.5 cm
 11. 6.6 cm 12. $4.9 \text{ cm}, 7.8 \text{ cm}$

page 144 Exercise 14

5. (a) A full circle

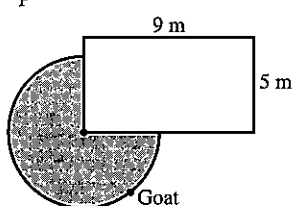
(b) An arc of a circle

(c) 60 circles

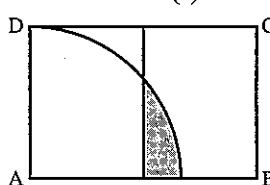
6. R_1



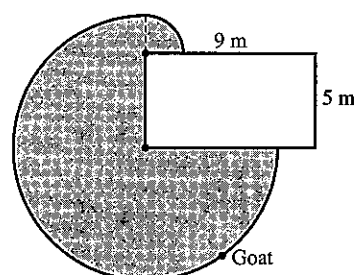
8. (a)



7. D



(b)



9. A line parallel to AB and 6 cm from AB

10. A spiral

11.



page 145 Exercise 15

1. (a), (b), (d)

2. (a) $a = 4$ cm, $x = 4$ cm, $y = 6$ cm

(b) 240 cm³

3. (a) $a = 10$ cm, $b = 6$ cm, $c = 10$ cm, $d = 10$ cm

(b) 64 cm³

4. (a) 168 mm²

(b) $16\,800$ mm³

5. $a = \sqrt{2}$, $b = \sqrt{2}$, $c = \sqrt{3}$, $x = \sqrt{2}$, $y = \sqrt{3}$

page 146 Revision exercise 4A

1. 80°

3. (a) 30°

(b) $22\frac{1}{2}^\circ$

(c) 12

4. (a) 40° (b) 100°

5. 4.12 cm

6. (i) 3 cm (ii) 5.66 cm

7. (c) $2\frac{4}{5}$ cm

8. (b) 6 cm 9. $3\frac{2}{3}$ cm, $1\frac{1}{11}$ cm

10. 6 cm

11. 250 cm³

12. (a) $3\frac{1}{3}$ cm (b) 1620 cm³

13. (a) 1 m²

(b) 1000 cm³

14. (a) 50° (b) 128°

(c) $c = 50^\circ$, $d = 40^\circ$

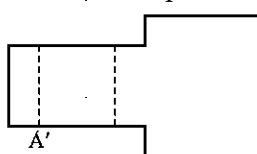
(d) $x = 10^\circ$, $y = 40^\circ$

15. (a) 55° (b) 45°

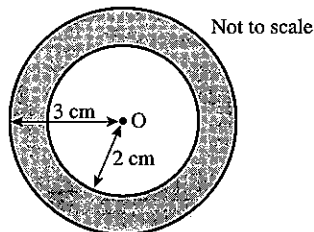
page 148 Examination exercise 4B

1. A: kite, B: trapezium

2.



3.



4. (b) 7
 (c) (ii) 14, 48 (iii) 20, 99 (iv) (4, 3, 5) or (6, 8, 10) or (8, 15, 17) or (10, 24, 26) or (12, 35, 37)
 5. $\frac{9}{16} \text{ m}^2$ 6. (c) (i) $AE = 5.8 \text{ cm}$ (iii) cyclic 7. $w = 56, x = 68, y = 22, z = 44$
 8. (a) (i) 17.7 cm (ii) 9.6° (iii) 18.9 (iv) (a) 113 (b) 60°
 (b) (i) (a) $1:2$ (b) $1:4$ (c) $1:8$ (ii) 18π (iii) $\frac{7}{8}V$
 9. (a) (i) 66° (ii) equal angles (iii) $PB = 16 \text{ cm}, CD = 8.75 \text{ cm}$ (iv) $\frac{1}{4}n$ (b) (i) 48° (ii) 23 cm
 10. (a) 18 (b) 30

5 Algebra 2

page 154 Exercise 1

1. $\frac{5}{7}$ 2. $\frac{7}{8}$ 3. $5y$ 4. $\frac{1}{2}$ 5. 4 6. $\frac{x}{2y}$
 7. 2 8. $\frac{a}{2}$ 9. $\frac{2b}{3}$ 10. $\frac{a}{5b}$ 11. a 12. $\frac{7}{8}$
 13. $\frac{5+2x}{3}$ 14. $\frac{3x+1}{x}$ 15. $\frac{32}{25}$ 16. $\frac{4+5a}{5}$ 17. $\frac{3}{4-x}$ 18. $\frac{b}{3+2a}$
 19. $\frac{5x+4}{8x}$ 20. $\frac{2x+1}{y}$ 21. $\frac{x+2y}{3xy}$ 22. $\frac{6-b}{2a}$ 23. $\frac{2b+4a}{b}$ 24. $x-2$

page 154 Exercise 2

1. $\frac{x+2}{x-3}$ 2. $\frac{x}{x+1}$ 3. $\frac{x+4}{2(x-5)}$ 4. $\frac{x+5}{x-2}$ 5. $\frac{x+3}{x+2}$ 6. $\frac{x+5}{x-2}$
 7. $\frac{x+2}{x}$ 8. $\frac{3x}{x+5}$ 9. $\frac{1}{2}$ 10. $\frac{3x}{x-5}$ 11. $\frac{3x-5}{x}$ 12. $\frac{x-2}{x-1}$

page 155 Exercise 3

1. $\frac{3}{5}$ 2. $\frac{3x}{5}$ 3. $\frac{3}{x}$ 4. $\frac{4}{7}$ 5. $\frac{4x}{7}$
 6. $\frac{4}{7x}$ 7. $\frac{7}{8}$ 8. $\frac{7x}{8}$ 9. $\frac{7}{8x}$ 10. $\frac{5}{6}$
 11. $\frac{5x}{6}$ 12. $\frac{5}{6x}$ 13. $\frac{23}{20}$ 14. $\frac{23x}{20}$ 15. $\frac{23}{20x}$
 16. $\frac{1}{12}$ 17. $\frac{x}{12}$ 18. $\frac{1}{12x}$ 19. $\frac{5x+2}{6}$ 20. $\frac{7x+2}{12}$
 21. $\frac{9x+13}{10}$ 22. $\frac{1-2x}{12}$ 23. $\frac{2x-9}{15}$ 24. $\frac{-3x-12}{14}$ 25. $\frac{3x+1}{x(x+1)}$
 26. $\frac{7x-8}{x(x-2)}$ 27. $\frac{8x+9}{(x-2)(x+3)}$ 28. $\frac{4x+11}{(x+1)(x+2)}$ 29. $\frac{-3x-17}{(x+3)(x-1)}$ 30. $\frac{11-x}{(x+1)(x-2)}$

page 156 Exercise 4

1. $2\frac{1}{2}$
2. 3
3. $\frac{B}{A}$
4. $\frac{T}{N}$
5. $\frac{K}{M}$
6. $\frac{4}{y}$
7. $\frac{C}{B}$
8. $\frac{D}{4}$
9. $\frac{T+N}{9}$
10. $\frac{B-R}{A}$
11. $\frac{R+T}{C}$
12. $\frac{N-R^2}{L}$
13. $\frac{R-S^2}{N}$
14. 2
15. -7
16. $T-A$
17. $S-B$
18. $N-D$
19. $M-B$
20. $L-D^2$
21. $T-N^2$
22. $N+M-L$
23. $R-S-Z$
24. 7
25. $A+R$
26. $E+A$
27. $F+B$
28. F^2+B^2
29. $A+B+D$
30. A^2+E
31. $L+B$
32. $N+T$
33. 2
34. $4\frac{1}{2}$
35. $\frac{N-C}{A}$
36. $\frac{L-D}{B}$
37. $\frac{F-E}{D}$
38. $\frac{H+F}{N}$
39. $\frac{T+Z}{Y}$
40. $\frac{B+L}{R}$
41. $\frac{Q-m}{V}$
42. $\frac{n+a+m}{t}$
43. $\frac{s-t-n}{q}$
44. $\frac{t+s^2}{n}$
45. $\frac{c-b}{V^2}$
46. $\frac{r+6}{n}$
47. $\frac{s-d}{m}$
48. $\frac{t+b}{m}$
49. $\frac{j-c}{m}$
50. 2
51. $2\frac{2}{3}$
52. $\frac{C-AB}{A}$
53. $\frac{F-DE}{D}$
54. $\frac{a-hn}{h}$
55. $\frac{q+bd}{b}$
56. $\frac{n-rt}{r}$
57. $\frac{b+4t}{t}$
58. $\frac{z-St}{S}$
59. $\frac{s+vd}{v}$
60. $\frac{g-mn}{m}$

page 157 Exercise 5

1. 12
2. 10
3. BD
4. TB
5. RN
6. bm
7. 26
8. $BT+A$
9. $AN+D$
10. B^2N-Q
11. $ge+r$
12. $4\frac{1}{2}$
13. $\frac{DC-B}{A}$
14. $\frac{pq-m}{n}$
15. $\frac{vS+t}{r}$
16. $\frac{qt+m}{z}$
17. $\frac{bc-m}{A}$
18. $\frac{AE-D}{B}$
19. $\frac{nh+f}{e}$
20. $\frac{qr-b}{g}$
21. 4
22. -2
23. 2
24. $A-B$
25. $C-E$
26. $D-H$
27. $n-m$
28. $q-t$
29. $s-b$
30. $r-v$
31. $m-t$
32. 2
33. $\frac{T-B}{X}$
34. $\frac{M-Q}{N}$
35. $\frac{V-T}{M}$
36. $\frac{N-L}{R}$
37. $\frac{v^2-r}{r}$
38. $\frac{w-t^2}{n}$
39. $\frac{n-2}{q}$
40. $\frac{1}{4}$
41. $-\frac{1}{7}$
42. $\frac{B-DE}{A}$
43. $\frac{D-NB}{E}$
44. $\frac{h-bx}{f}$
45. $\frac{v^2-Cd}{h}$
46. $\frac{NT-MB}{M}$
47. $\frac{mB+ef}{fN}$
48. $\frac{TM-EF}{T}$
49. $\frac{yx-zt}{y}$
50. $\frac{k^2m-x^2}{k^2}$

page 158 Exercise 6

1. $\frac{1}{2}$
2. $1\frac{2}{3}$
3. $\frac{B}{C}$
4. $\frac{T}{X}$
5. $\frac{M}{B}$
6. $\frac{n}{m}$
7. $\frac{v}{t}$
8. $\frac{n}{\sin 20^\circ}$
9. $\frac{7}{\cos 30^\circ}$
10. $\frac{B}{x}$
11. $6\frac{2}{3}$
12. $\frac{ND}{B}$
13. $\frac{HM}{N}$
14. $\frac{et}{b}$
15. $\frac{vs}{m}$
16. $\frac{mb}{t}$
17. $1\frac{1}{2}$
18. $3\frac{1}{3}$
19. $\frac{B-DC}{C}$
20. $\frac{Q+TC}{T}$
21. $\frac{V+TD}{D}$
22. $\frac{L}{MB}$
23. $\frac{N}{BC}$
24. $\frac{m}{cd}$
25. $\frac{tc-b}{t}$
26. $\frac{xy-z}{x}$
27. 1
28. $\frac{5}{6}$
29. $\frac{A}{C-B}$
30. $\frac{V}{H-G}$
31. $\frac{r}{n+t}$
32. $\frac{b}{q-d}$
33. $\frac{m}{t+n}$
34. $\frac{b}{d-h}$
35. $\frac{d}{C-e}$
36. $\frac{m}{r-e^2}$
37. $\frac{n}{b-t^2}$
38. $\frac{d}{mn-b}$
39. $\frac{M-Nq}{N}$
40. $\frac{Y+Tc}{T}$
41. $\frac{N-2MP}{2M}$
42. $\frac{B-6Ac}{6A}$
43. $\frac{K}{(C-B)M}$
44. $\frac{z}{y(y+z)}$
45. $\frac{m^2}{n-p}$
46. $\frac{q}{w-t}$

page 159 Exercise 7

1. 4
2. 24
3. 11
4. $B^2 - A$
5. $D^2 - C$
6. $H^2 + E$
7. $\frac{c^2 - b}{a}$
8. $a^2 + m$
9. $\frac{b^2 + t}{g}$
10. $b - r^2$
11. $d - t^2$
12. $b^2 + d$
13. $n - c^2$
14. $b - f^2$
15. $c - g^2$
16. $\frac{M - P^2}{N}$
17. $\frac{D - B}{A}$
18. $A^4 + D$
19. $\pm\sqrt{g}$
20. ± 4
21. $\pm\sqrt{B}$
22. $\pm\sqrt{(B - A)}$
23. $\pm\sqrt{(M + A)}$
24. $\pm\sqrt{(b - a)}$
25. $\pm\sqrt{(C - m)}$
26. $\pm\sqrt{(d - n)}$
27. $\pm\sqrt{\frac{n}{m}}$
28. $\pm\sqrt{\frac{b}{a}}$
29. $\frac{at}{z}$
30. $\pm\sqrt{\left(\frac{m+t}{a}\right)}$
31. $\pm\sqrt{(a - n)}$
32. $\pm\sqrt{40}$
33. $\pm\sqrt{(B^2 + A)}$
34. $\pm\sqrt{(x^2 - y)}$
35. $\pm\sqrt{(t^2 - m)}$
36. 8
37. $\frac{M^2 - A^2 B}{A^2}$
38. $\frac{M}{N^2}$
39. $\frac{N}{B^2}$
40. $a - b^2$
41. $\pm\sqrt{(a^2 - t^2)}$
42. $\pm\sqrt{(m - x^2)}$
43. $\frac{4}{\pi^2} - t$
44. $\frac{B^2}{A^2} - 1$
45. $\pm\sqrt{\left(\frac{C^2 + b}{a}\right)}$
46. $\pm\sqrt{\left(\frac{b^2 + a^2 x}{a^2}\right)}$
47. $\pm\sqrt{(x^2 - b)}$
48. $\pm\sqrt{(c - b)a}$
49. $\frac{c^2 - b^2}{a}$
50. $\pm\sqrt{\left(\frac{m}{a+b}\right)}$

page 160 Exercise 8

1. $3\frac{2}{3}$
2. 3
3. $\frac{D-B}{2N}$
4. $\frac{E+D}{3M}$
5. $\frac{2b}{a-b}$
6. $\frac{e+c}{m+n}$
7. $\frac{3}{x+k}$
8. $\frac{C-D}{R-T}$
9. $\frac{z+x}{a-b}$
10. $\frac{nb-ma}{m-n}$
11. $\frac{d+xb}{x-1}$
12. $\frac{a-ab}{b+1}$
13. $\frac{d-c}{d+c}$
14. $\frac{M(b-a)}{b+a}$
15. $\frac{n^2-mn}{m+n}$
16. $\frac{m^2+5}{2-m}$
17. $\frac{2+n^2}{n-1}$
18. $\frac{e-b^2}{b-a}$
19. $\frac{3x}{a+x}$
20. $\frac{e-c}{a-d}$ or $\frac{c-e}{d-a}$
21. $\frac{d}{a-b-c}$
22. $\frac{ab}{m+n-a}$
23. $\frac{s-t}{b-a}$ or $\frac{t-s}{a-b}$
24. $2x$
25. $\frac{v}{3}$
26. $\frac{a(b+c)}{b-2a}$
27. $\frac{5x}{3}$
28. $-\frac{4z}{5}$
29. $\frac{mn}{p^2-m}$
30. $\frac{mn+n}{4+m}$

page 161 Exercise 9

1. $-\left(\frac{by+c}{a}\right)$
2. $\pm\sqrt{\left(\frac{e^2+ab}{a}\right)}$
3. $\frac{n^2}{m^2}+m$
4. $\frac{a-b}{1+b}$
5. $3y$
6. $\frac{a}{e^2+c}$
7. $-\left(\frac{a+lm}{m}\right)$
8. $\frac{t^2g}{4\pi^2}$
9. $\frac{4\pi^2d}{t^2}$
10. $\pm\sqrt{\frac{a}{3}}$
11. $\pm\sqrt{\left(\frac{t^2e-ba}{b}\right)}$
12. $\frac{1}{a^2-1}$
13. $\frac{a+b}{x}$
14. $\pm\sqrt{(x^4-b^2)}$
15. $\frac{c-a}{b}$
16. $\frac{a^2-b}{a+1}$
17. $\pm\sqrt{\left(\frac{G^2}{16\pi^2}-T^2\right)}$
18. $-\left(\frac{ax+c}{b}\right)$
19. $\frac{1+x^2}{1-x^2}$
20. $\pm\sqrt{\left(\frac{a^2m}{b^2+n}\right)}$
21. $\frac{P-M}{E}$
22. $\frac{RP-Q}{R}$
23. $\frac{z-t^2}{x}$
24. $(g-e)^2-f$
25. $\frac{4np+me^2}{mn}$

page 163 Exercise 10

1. (a) $S=ke$ (b) $v=kt$ (c) $x=kz^2$ (d) $y=k\sqrt{x}$
- (e) $T=k\sqrt{L}$ (f) $C=kr$ (g) $A=kr^2$ (h) $V=kr^3$
2. (a) 9 (b) $2\frac{2}{3}$ 3. (a) 35 (b) 11
5.

x	1	3	4	$5\frac{1}{2}$
z	4	12	16	22

 6.

r	1	2	4	$1\frac{1}{2}$
V	4	32	256	$13\frac{1}{2}$

 7.

h	4	9	25	$2\frac{1}{4}$
w	6	9	15	$4\frac{1}{2}$
8. (a) 18 (b) 2 9. (a) 42 (b) 4 10. $333\frac{1}{3}$ N/cm³
11. 180 m; 2 s 12. 675 J; $\sqrt{\frac{4}{3}}$ cm 13. 4 cm; 49 h
14. $15\frac{5}{8}$ h 15. 9000 N; 25 m/s 16. $15^4 : 1$ (50 625 : 1)

page 165 Exercise 11

1. (a) $x=\frac{k}{y}$ (b) $s=\frac{k}{t^2}$ (c) $t=\frac{k}{\sqrt{q}}$ (d) $m=\frac{k}{w}$ (e) $z=\frac{k}{t^2}$
2. (a) 1 (b) 4 3. (a) $2\frac{1}{2}$ (b) $\frac{1}{2}$
4. (a) 36 (b) ± 4 5. (a) 1.2 (b) ± 2
6. (a) 16 (b) ± 10 7. (a) 6 (b) 16
8. (a) $\frac{1}{2}$ (b) $\frac{1}{20}$

9.	y	2	4	1	$\frac{1}{4}$
	z	8	4	16	64

10.	t	2	5	20	10
	y	25	4	$\frac{1}{4}$	1

11.	x	1	4	256	36
	r	12	6	$\frac{3}{4}$	2

12. (a) 6 (b) 50

14. $k = 100, n = 3$

13. (a) 0.36 (b) 6

15. $k = 12, n = 2$

	x	1	2	4	10
	z	100	$12\frac{1}{2}$	1.5625	$\frac{1}{10}$

	v	1	4	36	10 000
	y	12	6	2	$\frac{3}{25}$

16. 2.5 m^3 ; 200 N/m^2

17. 3 h; 48 men

18. 2 days; 200 days

19. 6 cm

page 168 Exercise 12

- | | | | | |
|---------------------------|-----------------------|----------------------|-----------------------|-----------------------|
| 1. 3^4 | 2. $4^2 \times 5^3$ | 3. 3×7^3 | 4. $2^3 \times 7$ | 5. 10^{-3} |
| 6. $2^{-2} \times 3^{-3}$ | 7. $15^{\frac{1}{2}}$ | 8. $3^{\frac{1}{3}}$ | 9. $10^{\frac{1}{3}}$ | 10. $5^{\frac{3}{2}}$ |
| 11. x^7 | 12. y^{13} | 13. z^4 | 14. z^{100} | 15. m |
| 16. e^{-5} | 17. y^2 | 18. w^6 | 19. y | 20. x^{10} |
| 21. 1 | 22. w^{-5} | 23. w^{-5} | 24. x^7 | 25. a^8 |
| 26. k^3 | 27. 1 | 28. x^{29} | 29. y^2 | 30. x^6 |
| 31. z^4 | 32. t^{-4} | 33. $4x^6$ | 34. $16y^{10}$ | 35. $6x^4$ |
| 36. $10y^5$ | 37. $15a^4$ | 38. $8a^3$ | 39. 3 | 40. $4y^2$ |
| 41. $\frac{5}{2}y$ | 42. $32a^4$ | 43. $108x^5$ | 44. $4z^{-3}$ | 45. $2x^{-4}$ |
| 46. $\frac{5}{2}y^5$ | 47. 1 | 48. $21w^{-3}$ | 49. $2n^4$ | 50. $2x$ |

page 168 Exercise 13

- | | | | | |
|--------------------|--------------------|---------------------|----------------------|---------------------|
| 1. 27 | 2. 1 | 3. $\frac{1}{9}$ | 4. 25 | 5. 2 |
| 6. 4 | 7. 9 | 8. 2 | 9. 27 | 10. 3 |
| 11. $\frac{1}{3}$ | 12. $\frac{1}{2}$ | 13. 1 | 14. $\frac{1}{5}$ | 15. 10 |
| 16. 8 | 17. 32 | 18. 4 | 19. $\frac{1}{9}$ | 20. $\frac{1}{8}$ |
| 21. 18 | 22. 10 | 23. 1000 | 24. $\frac{1}{1000}$ | 25. $\frac{1}{9}$ |
| 26. 1 | 27. $1\frac{1}{2}$ | 28. $\frac{1}{25}$ | 29. $\frac{1}{10}$ | 30. $\frac{1}{4}$ |
| 31. $\frac{1}{4}$ | 32. 100 000 | 33. 1 | 34. $\frac{1}{32}$ | 35. 0.1 |
| 36. 0.2 | 37. 1.5 | 38. 1 | 39. 9 | 40. $1\frac{1}{2}$ |
| 41. $\frac{3}{10}$ | 42. 64 | 43. $\frac{1}{100}$ | 44. $1\frac{2}{3}$ | 45. $\frac{1}{100}$ |
| 46. 1 | 47. 100 | 48. 6 | 49. 750 | 50. -7 |

page 169 Exercise 14

- | | | | | | |
|----------------|--------------------|----------------------|---------------------|--------------|-------------------------|
| 1. $25x^4$ | 2. $49y^6$ | 3. $100a^2b^2$ | 4. $4x^2y^4$ | 5. $2x$ | 6. $\frac{1}{9y}$ |
| 7. x^2 | 8. $\frac{x^2}{2}$ | 9. 1 | 10. $\frac{2}{x}$ | 11. $36x^4$ | 12. $25y$ |
| 13. $16x^2$ | 14. $27y$ | 15. 25 | 16. 1 | 17. 49 | 18. 1 |
| 19. $8x^6y^3$ | 20. $100x^2y^6$ | 21. $\frac{3x}{2}$ | 22. $\frac{2}{x}$ | 23. x^3y^5 | 24. $12x^3y^2$ |
| 25. $10y^4$ | 26. $3x^3$ | 27. $x^3y^2z^4$ | 28. x | 29. $3y$ | 30. $27x^{\frac{3}{2}}$ |
| 31. $10x^3y^5$ | 32. $32x^2$ | 33. $\frac{5}{2}x^2$ | 34. $\frac{9}{x^2}$ | 35. $2a^2$ | 36. $a^3b^3c^2$ |

37. (a) 2^5 (b) 2^7 (c) 2^6 (d) 2^0
 38. (a) 3^{-3} (b) 3^{-4} (c) 3^{-1} (d) 3^{-2}
 39. 16 40. $\frac{1}{4}$ 41. $\frac{1}{6}$ 42. 1 43. $16\frac{1}{8}$ 44. $\frac{3}{8}$
 45. $\frac{1}{4}$ 46. $\frac{5}{256}$ 47. $1\frac{1}{16}$ 48. 0 49. $\frac{1}{4}$ 50. $\frac{1}{4}$
 51. 3 52. 4 53. -1 54. -2 55. 3 56. 3
 57. 1 58. $\frac{1}{5}$ 59. 0 60. -4 61. 2 62. -5
 63. 1 64. $\frac{1}{18}$ 65. (a) 3.60 (b) 5.44

page 170 Exercise 15

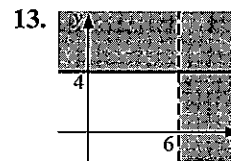
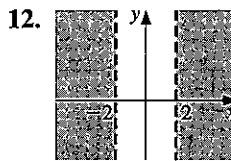
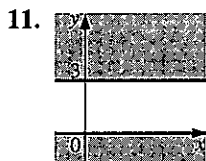
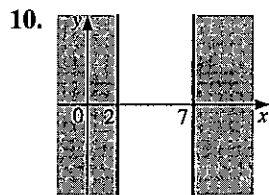
1. < 2. > 3. > 4. =
 5. < 6. < 7. = 8. >
 9. < 10. > 11. < 12. >
 13. > 14. > 15. = 16. F
 17. F 18. T 19. F 20. F
 21. T 22. T 23. F 24. F
 25. $x > 13$ 26. $x < -1$ 27. $x < 12$ 28. $x \leq 2\frac{1}{2}$
 29. $x > 3$ 30. $x \geq 8$ 31. $x < \frac{1}{4}$ 32. $x \geq -3$
 33. $x < -8$ 34. $x < 4$ 35. $x > -9$ 36. $x < 8$
 37. $x > 3$ 38. $x \geq 1$ 39. $x < 1$ 40. $x > 2\frac{1}{3}$

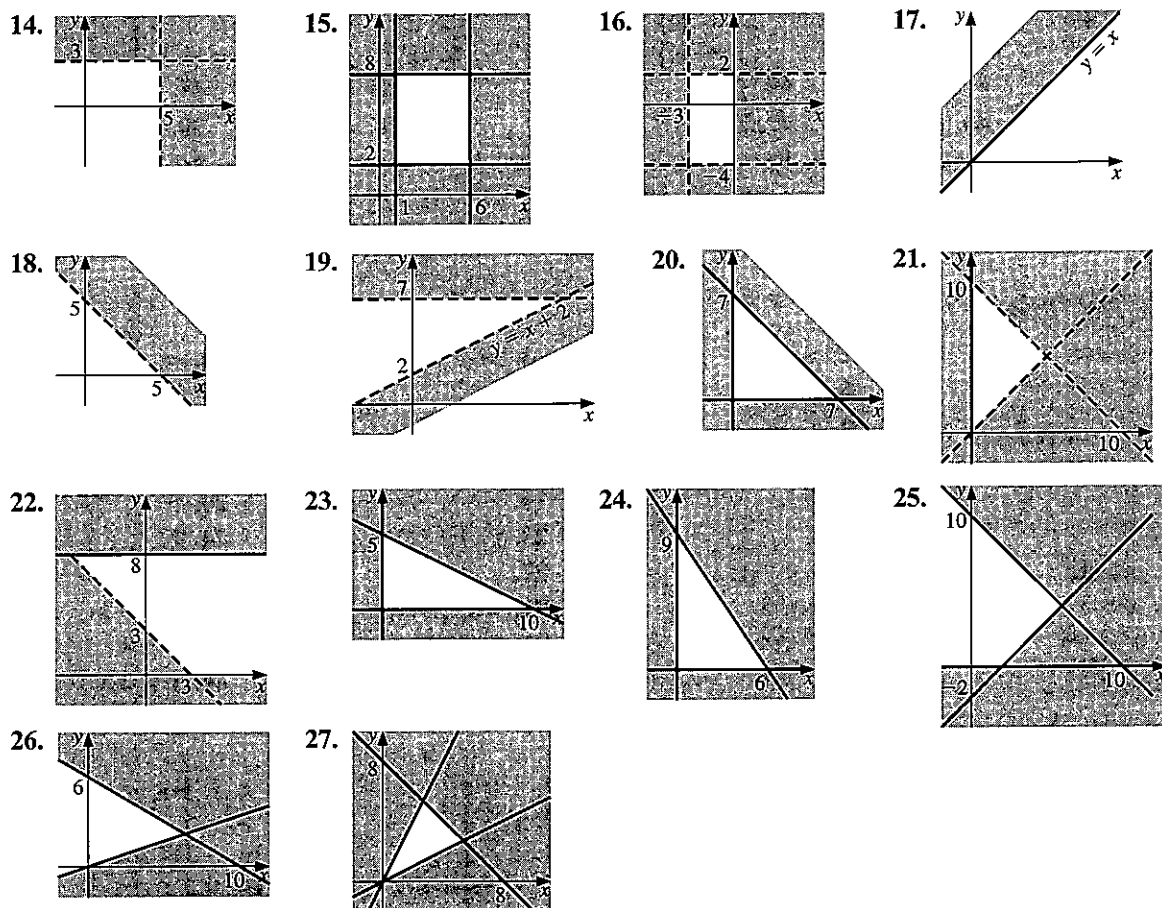
page 171 Exercise 16

1. $x > 5$ 2. $x \leq 3$ 3. $x > 6$ 4. $x \geq 4$
 5. $x < 1$ 6. $x < -3$ 7. $x > 0$ 8. $x > 4$
 9. $x > 2$ 10. $x < -3$ 11. $1 < x < 4$ 12. $-2 \leq x \leq 5$
 13. $1 \leq x < 6$ 14. $0 \leq x < 5$ 15. $-1 \leq x \leq 7$ 16. $0.2 < z < 2$
 17. $x > 80$ 18. $x > 10$ 19. $x < -2.5$ 20. $0 < x < 4$
 21. $5 \leq x \leq 9$ 22. $-1 < x < 4$ 23. $5.5 \leq x \leq 6$ 24. $\frac{1}{2} < x < 8$
 25. $-8 < x < 2$ 26. $\{1, 2, 3, 4, 5, 6\}$ 27. $\{7, 11, 13, 17, 19\}$ 28. $\{2, 4, 6, 8, 10\}$
 29. $\{4, 9, 16, 25, 36, 49\}$ 30. $\{5, 10\}$ 31. $\{-4, -3, -2, -1\}$ 32. $\{2, 3, 4, \dots, 12\}$
 33. $\{1, 4, 9\}$ 34. $\{2, 3, 5, 7, 11\}$ 35. $\{2, 4, 6, \dots, 18\}$ 36. $n = 5$
 37. $x = 7$ 38. $y = 5$ 39. $4 < z < 5$ 40. $4 < p < 5$
 41. $\frac{1}{2}$ (or other values) 42. 1, 2, 3, ... 14 43. 19 44. $\frac{1}{2}$ (or other values)
 45. 19
 46. (a) $-3 \leq x < 6$ (b) $-2 < x < 2$ (c) $-3 \leq x \leq 2$ (d) $-3 \leq x < 7$ 47. 17

page 173 Exercise 17

1. $x \leq 3$ 2. $y \geq 2\frac{1}{2}$ 3. $1 \leq x \leq 6$
 4. $x < 7, y < 5$ 5. $y \geq x$ 6. $x + y < 10$
 7. $x < 8, y > -2, y < x$ 8. $x \geq 0, y \geq x - 1, x + y \leq 7$ 9. $y \geq 0, y \leq x + 2, x + y \leq 6$



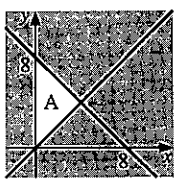


page 175 Exercise 18

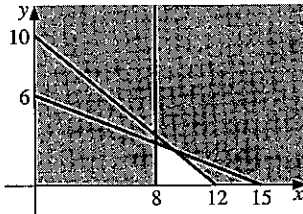
1. (a) maximum value = 26 at (6, 5) (b) minimum value = 12 at (3, 3)
2. (a) maximum value = 25 at (8, 3) (b) minimum value = 9 at (7, 2)
3. (a) maximum value = 40 at (20, 0) (b) minimum value = 112 at (14, 8)
4. (3, 3), (4, 2), (4, 3), (4, 4), (5, 1), (5, 2), (6, 0)
5. (0, 6), (0, 7), (0, 8), (1, 5), (1, 6), (2, 4) 6. (3, 2), (2, 3), (2, 4), (2, 5), (1, 4), (1, 5), (0, 5), (0, 6)
7. (2, 4), (2, 5), (2, 6), (2, 7), (2, 8), (2, 9), (2, 10), (3, 6), (3, 7), (3, 8)
8. (a) (6, 7), (7, 7), (8, 6), (7, 6), (6, 8) (b) 7 defenders, 6 forwards have lowest wage bill (\$190)
9. (a) 18 (b) \$2.60
10. (a) 14 (b) (7, 7), \$154 000 (c) (13, 3), \$190 000
11. (a) 10 (b) \$250, (4, 7)
12. (a) (6, 12), \$1440 (b) (10, 10), \$1800
13. (14, 11), \$1360
14. (a) (9, 7), \$44 (b) (15, 5), \$45

page 178 Revision exercise 5A

1. (a) $\frac{9x}{20}$ (b) $\frac{7}{6x}$ (c) $\frac{5x-2}{6}$ (d) $\frac{5x+23}{(x-1)(x+3)}$
2. (a) $(x-2)(x+2)$ (b) $\frac{3}{x+2}$

3. (a) $s = t(r + 3)$ (b) $r = \frac{s - 3t}{t}$ (c) $t = \frac{s}{r + 3}$
 4. (a) $z = x - 5y$ (b) $m = \frac{11}{k + 3}$ (c) $z = \frac{T^2}{C^2}$
 5. (a) 50 (b) 50 6. (a) 16 (b) ± 4
 7. (a) (i) 3 (ii) 4 (b) (i) 4 (ii) 0
 8. (a) 9, 10 (b) 2, 3, 4, 5 9. $\frac{t^2}{k^2} - 5$ 10. $\frac{z + 2}{z - 3}$
 11. (a) $\frac{3}{5}$ (b) $\frac{k(1 - y)}{y}$ 12. 
 13. (a) $1\frac{5}{6}$ (b) 0.09 14. 21
 15. (a) $\frac{5 + a^2}{2 - a}$ (b) $-\left(\frac{cz + b}{a}\right)$ (c) $\frac{a^2 + 1}{a^2 - 1}$
 16. (a) $\frac{7}{2x}$ (b) $\frac{3a + 7}{a^2 - 4}$ (c) $\frac{x - 8}{x(x + 1)(x - 2)}$
 17. $p = \frac{10t^2}{s}$ 18. 6 or 7 19. $y \geq 2, x + y \leq 6, y \leq 3x$
 20. $x \geq 0, y \geq x - 2, x + y \leq 7, y \geq 0$ 22. (a) 512 (b) 6h (c) 2^{21}

page 180 **Examination exercise 5B**

1. (a) 27 (b) $\frac{1}{2x}$ 2. (a) 24 (b) 36 (c) 1
 3. (a) $ar = 48$ (b) 4.8 4. (a) 18 (b) 0 (c) 16
 5. 3 6. $x \geq 1, y \leq 5, y \leq x + 2$ (e) \$470
 7. (b) $5x + 5y \leq 60$ (c) $x \geq 8$ (d) 
 8. (b) $x + 2y = 120$ (c) for example, 60 cars and 30 trucks
 9. $4 < x < 6$ 10. $\frac{x + 11}{(x - 3)(x + 4)}$

6 Trigonometry

page 184 **Exercise 2**

- | | | | | |
|-------------|-------------|--------------|-------------|-------------|
| 1. 4.54 | 2. 3.50 | 3. 3.71 | 4. 6.62 | 5. 8.01 |
| 6. 31.9 | 7. 45.4 | 8. 4.34 | 9. 17.1 | 10. 13.2 |
| 11. 38.1 | 12. 3.15 | 13. 516 | 14. 79.1 | 15. 5.84 |
| 16. 2.56 | 17. 18.3 | 18. 8.65 | 19. 11.9 | 20. 10.6 |
| 21. 119 | 22. 10.1 | 23. 3.36 cm | 24. 4.05 cm | 25. 4.10 cm |
| 26. 11.7 cm | 27. 9.48 cm | 28. 5.74 cm | 29. 9.53 cm | 30. 100 m |
| 31. 56.7 m | 32. 16.3 cm | 33. 0.952 cm | 34. 8.27 m | |

page 186 Exercise 3

1. 5, 5.55 2. 13.1, 27.8 3. 34.6, 41.3 4. 20.4, 11.7 5. 94.1, 94.1
 6. 15.2, 10, 6.43 7. 4.26 8. 3.50 9. 26.2 10. 8.82
 11. (a) 17.4 cm (b) 11.5 cm (c) 26.5 cm 12. (a) 6.82 cm (b) 6.01 cm (c) 7.31 cm

page 188 Exercise 4

1. 36.9° 2. 44.4° 3. 48.2° 4. 60° 5. 36.9° 6. 50.2°
 7. 29.0° 8. 56.4° 9. 38.9° 10. 43.9° 11. 41.8° 12. 39.3°
 13. 60.3° 14. 50.5° 15. 13.6° 16. 34.8° 17. 60.0° 18. 42.0°
 19. 36.9° 20. 51.3° 21. 19.6° 22. 17.9° 23. 32.5° 24. 59.6°
 25. 54.8° 26. 46.3°

page 191 Exercise 5

1. 19.5° 2. 4.1 m 3. (a) 26.0 km (b) 23.4 km
 4. (a) 88.6 km (b) 179.3 km 5. 4.1 m 6. 8.6 m
 7. (a) 484 km (b) 858 km (c) 985 km, 060.6°
 8. 954 km, 133° 9. 56.3° 10. 35.5° 11. 71.6°
 12. 91.8° 13. 180 m 14. 36.4° 15. 10.3 cm
 16. 9.51 cm 17. 71.1° 18. 67.1 m 19. 138 m
 20. 83.2 km 21. 60° 22. 13.9 cm 23. Yes
 24. 11.1 m; 11.1 s; 222 m 25. 4.4 m

page 193 Exercise 6

1. 100 m 2. 89 n miles 3. 103 km
 4. 99 km; 024° 5. 9190 km/h; 255° 6. 11 km

page 194 Exercise 7

1. (a) 13 cm (b) 13.6 cm (c) 17.1°
 2. (a) 4.04 m (b) 38.9° (c) 11.2 m (d) 19.9°
 3. (a) 8.49 cm (b) 8.49 cm (c) 10.4 cm (d) 35.3° (e) 35.3°
 4. (a) 10 m (b) 7.81 m (c) 9.43 m (d) 70.2°
 5. (a) 14.1 cm (b) 18.7 cm (c) 69.3° (d) 29.0° (e) 41.4°
 6. (a) 4.47 m (b) 7.48 m (c) 63.4° (d) 74.5° (e) 53.3°
 7. 10.8 cm; 21.8°
 8. (a) $h \tan 65^\circ$ or $\frac{h}{\tan 25^\circ}$ (b) $h \tan 57^\circ$ or $\frac{h}{\tan 33^\circ}$ (c) 22.7 m
 9. 22.6 m 10. 55.0 m 11. 7.26 m 12. 43.3°

page 198 Exercise 8

3. 162° 4. 153° 5. (a) 140° (b) 110° (c) 50°
 6. 290° 7. 315° 8. (a) 350° (b) 304° (c) 60°
 9. 160° 10. 82° 11. 240° 12. 58°, 122° 13. 20.5°, 159.5° 14. 53.1°, 306.9°
 15. (a) 46.1°, 133.9° (b) 72.5°, 287.5° (c) 45.6°, 314.4° (d) 220.5°, 319.5°
 16. 30°, 150°, 210°, 330°
 17. (a) 41°, 139° (b) 30°, 150°
 18. (a) (i) 16°, 111° (ii) 153° (b) 2.2 (c) 63°
 19. (a) 48°, 205° (b) 37°, 217°

page 200 **Exercise 9**

- | | | | | |
|-------------------|------------|------------|------------|-------------------|
| 1. 6.38 m | 2. 12.5 m | 3. 5.17 cm | 4. 40.4 cm | 5. 7.81 m, 7.10 m |
| 6. 3.55 m, 6.68 m | 7. 8.61 cm | 8. 9.97 cm | 9. 8.52 cm | 10. 15.2 cm |
| 11. 35.8° | 12. 42.9° | 13. 32.3° | 14. 37.8° | 15. 35.5°, 48.5° |
| 16. 68.8°, 80.0° | 17. 64.6° | 18. 34.2° | 19. 50.6° | 20. 39.1° |
| 21. 39.5° | 22. 21.6° | | | |

page 203 **Exercise 10**

- | | | | | |
|-----------|-----------------------------|------------|------------|-----------|
| 1. 6.24 | 2. 6.05 | 3. 5.47 | 4. 9.27 | 5. 10.1 |
| 6. 8.99 | 7. 5.87 | 8. 4.24 | 9. 11.9 | 10. 154 |
| 11. 25.2° | 12. 78.5° | 13. 115.0° | 14. 111.1° | 15. 24.0° |
| 16. 92.5° | 17. 99.9° | 18. 38.2° | 19. 137.8° | 20. 34.0° |
| 21. 60.2° | 22. $\hat{B} = 112.2^\circ$ | 23. 94.55° | 24. 51.2° | |

page 204 **Exercise 11**

- | | | | |
|---------------------------|-----------------------------------|-------------------|-----------|
| 1. 6.7 cm | 2. 10.8 m | 3. 35.6 km | 4. 25.2 m |
| 5. 38.6°, 48.5°, 92.9° | 6. 40.4 m | 7. 9.8 km; 085.7° | |
| 8. (a) 29.6 km (b) 050.5° | 9. (a) 10.8 m (b) 72.6° (c) 32.6° | | |
| 10. 378 km, 048.4° | 11. (a) 62.2° (b) 2.33 km | 12. 9.64 m | |
| 13. 8.6° | | | |

page 206 **Revision exercise 6A**

- | |
|--|
| 1. (a) 45.6° (b) 58.0° (c) 3.89 cm (d) 33.8 m |
| 2. (a) 1.75 (b) 60.3° 3. (a) 12.7 cm (b) 5.92 cm (c) 36.1° |
| 4. 5.39 cm 5. (a) 220° (b) 295° |
| 6. 0.335 m |
| 7. (a) 6.61 cm (b) 12.8 cm (c) 5.67 cm 8. (a) 86.9 cm (b) 53.6 cm (c) 133 cm |
| 9. 52.4 m 10. (a) 14.1 cm (b) 35.3° (c) 35.3° |
| 11. (a) 6.63 cm (b) 41.8° 12. (a) 11.3 cm (b) 8.25 cm (c) 55.6° |
| 13. 45.2 km, 33.6 km 14. 73.4° 15. 8.76 m, 9.99 m |
| 16. 0.539 17. 4.12 cm, 9.93 cm 18. 26.4° |

page 208 **Examination exercise 6B**

- | | | | |
|--|---------------------------|----------|-----------|
| 1. 26 m | 2. (a) 102.7° (b) 68.2° | 3. 22.5° | 4. 66.0 m |
| 5. (b) (i) 22 km (ii) 35.3° (iii) 240.3° | | | |
| 6. (a) (i) 062° (ii) 201° (b) 420 m (c) 394 m (d) 42 | | | |
| 7. (a) 64.3 m (b) 58.3 m | | | |
| 8. (a) (i) 8 (ii) 6 (iii) 12 (b) (i) 4.24 cm (ii) 2.12 cm (iii) 45.0° (c) 12.7 cm ³ | | | |
| 9. 240 | 10. (a) 45, 225 (b) 157.5 | | |

7 Graphs

page 212 **Exercise 1**

For questions 1 to 10 end points of lines are given.

- | | | |
|------------------------|-------------------------|------------------------|
| 1. (-3, -5) and (3, 7) | 2. (-3, -13) and (3, 5) | 3. (-3, -7) and (3, 5) |
| 4. (-2, 10) and (4, 4) | 5. (-2, 14) and (4, 2) | 6. (-3, 1) and (3, 4) |

7. $(-3, -15)$ and $(3, 3)$ 8. $(-3, 2\frac{1}{2})$ and $(3, 5\frac{1}{2})$ 9. $(-2, -7)$ and $(4, 5)$
 10. $(-2, 18)$ and $(4, 0)$ 11. $(0, 0)$, $(1, 4)$, $(1.6, 1.6)$ 12. $(0, 1)$, $(2\frac{1}{4}, 1)$, $(4\frac{1}{2}, 10)$
 13. $(-2, -6)$, $(1.25, 3.75)$, $(4.5, 0.5)$ 14. $(-1.5, 1.5)$, $(0.67, 8)$, $(3.5, 8)$, $(3.5, -3.5)$
 15. $(4, -2)$, $(0.33, 5.33)$, $(-2.28, -5.14)$ 16. $(-2, 3)$, $(0.6, 8.2)$, $(2.5, 2.5)$, $(1.33, 1.33)$
 17. (a) \$560 (b) 2400 km 18. (a) 3.4 (b) 3 h 20 m
 19. (a) \$440 (b) 42 km/h 20. (a) \$4315 (b) 26 000 km

page 214 Exercise 2

1. $1\frac{1}{2}$ 2. 2 3. 3 4. $1\frac{1}{2}$ 5. $\frac{1}{2}$ 6. $-\frac{1}{6}$
 7. -7 8. -1 9. 4 10. -4 11. 5 12. $-1\frac{3}{7}$
 13. 6 14. 0 15. 0 16. infinite 17. infinite 18. -8
 19. $5\frac{1}{3}$ 20. 0 21. $\frac{b-d}{a-c}$ or $\frac{d-b}{c-a}$ 22. $\frac{n+b}{m-a}$ 23. $\frac{2f}{a}$
 24. -4 25. 0 26. $-\frac{6d}{c}$ 27. (a) $-1\frac{1}{5}$ (b) $\frac{1}{10}$ (c) $\frac{4}{5}$
 28. (a) infinite (b) $-\frac{3}{10}$ (c) $\frac{3}{10}$ 29. $3\frac{1}{2}$
 30. (a) $\frac{n+4}{2m-3}$ (b) $n = -4$ (c) $m = 1\frac{1}{2}$

page 215 Exercise 3

1. 1, 3 2. 1, -2 3. 2, 1 4. 2, -5 5. 3, 4
 6. $\frac{1}{2}$, 6 7. 3, -2 8. 2, 0 9. $\frac{1}{4}$, -4 10. -1, 3
 11. -2, 6 12. -1, 2 13. -2, 3 14. -3, -4 15. $\frac{1}{2}$, 3
 16. $-\frac{1}{3}$, 3 17. 4, -5 18. $1\frac{1}{2}$, -4 19. 10, 0 20. 0, 4

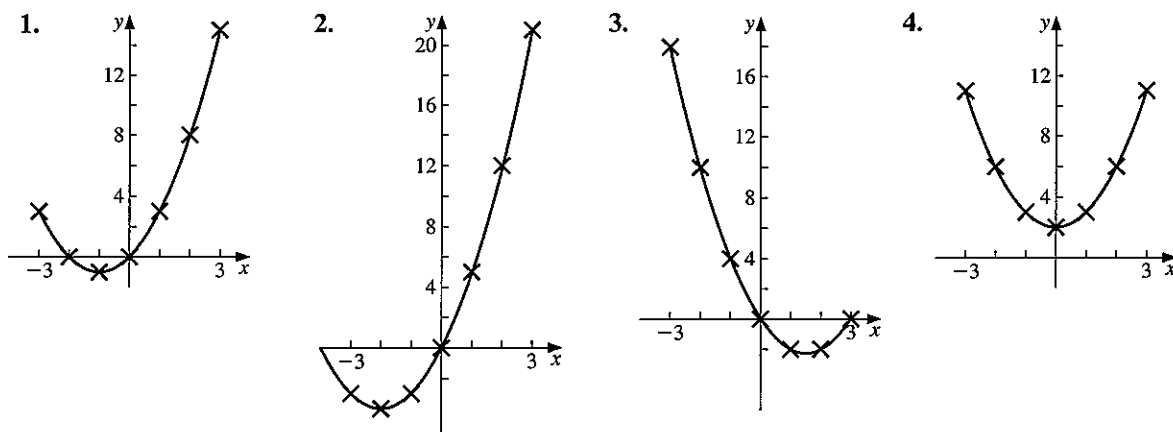
page 216 Exercise 4

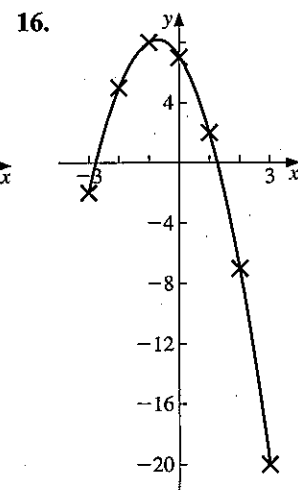
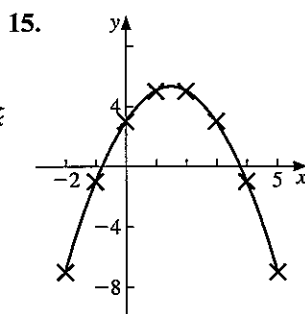
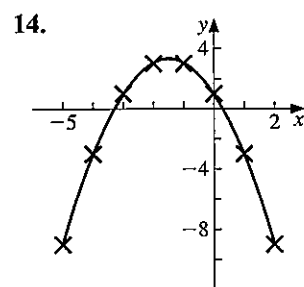
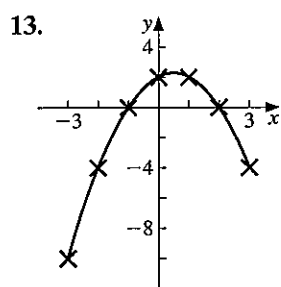
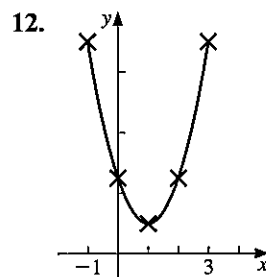
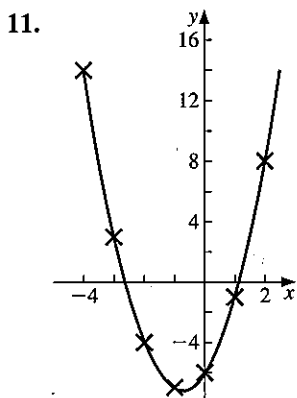
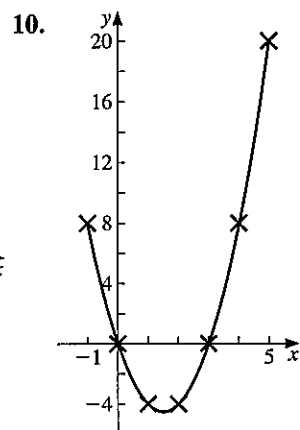
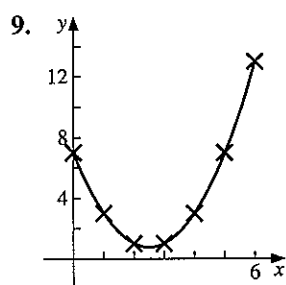
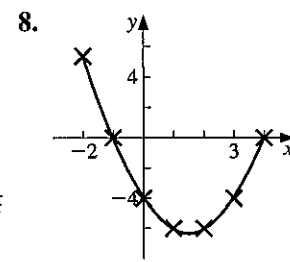
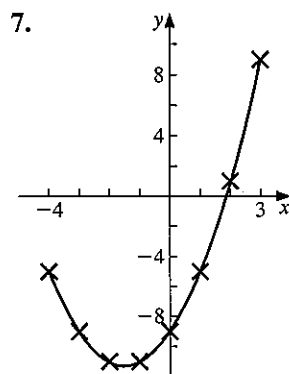
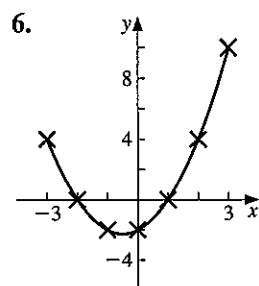
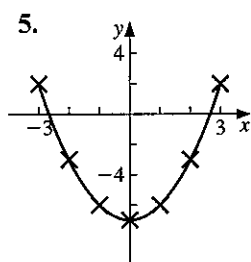
1. $y = 3x + 7$ 2. $y = 2x - 9$ 3. $y = -x + 5$ 4. $y = 2x - 1$
 5. $y = 3x + 5$ 6. $y = -x + 7$ 7. $y = \frac{1}{2}x - 3$ 8. $y = 2x - 3$
 9. $y = 3x - 11$ 10. $y = -x + 5$ 11. $y = \frac{1}{3}x - 4$

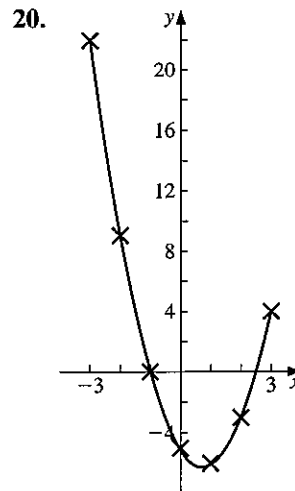
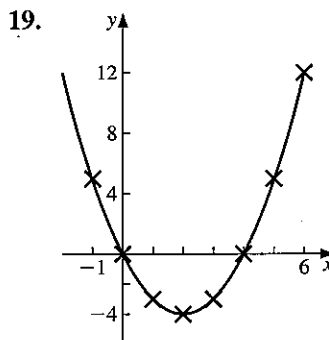
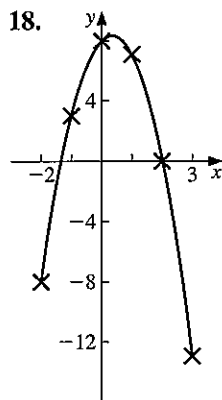
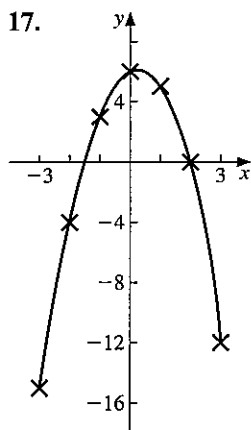
page 216 Exercise 5

1. $y = x + 2$ 2. $y = 2x - 2$ 3. $y = 5 - x$
 4. $m = 2$, $c = 3$ 5. $n = -2.5$, $k = 15$ 6. $m = 0.2$, $c = 3$

page 218 Exercise 6







page 219 Exercise 7

- | | | | | | |
|--------------|----------|---------------|---------------|----------|-------------------|
| 1. (a) 4 | (b) 8 | (c) 10.6 | 2. (a) 3 | (b) -5 | (c) 1.5 |
| 3. (a) 7.25 | (b) -2 | (c) -0.8, 3.8 | 15. (a) 0.75 | (b) 1.23 | |
| 16. (a) 3.13 | (b) 3.35 | | 17. (a) -2.45 | (b) 1.4 | |
| 18. (a) 5 | (b) 10.1 | 9c) -1.25 | 20. (a) 245 | (b) 41 | (c) $25 < x < 67$ |

page 221 Exercise 8

- | | | |
|--|---|--------------------------|
| 1. (a) 10.7 cm^2 | (b) $1.7 \text{ cm} \times 53 \text{ cm}$ | (c) 12.25 cm^2 |
| (d) $3.5 \text{ cm} \times 3.5 \text{ cm}$ | (e) square | |
| 2. $15 \text{ m} \times 30 \text{ m}$ | 3. (a) 2.5 s | (b) 31.3 m |
| 4. (a) 108 m/s | (b) 1.4 s | (c) $2.3 < t < 3.6$ |
| 10. (d) 1.41 ± 0.02 | (e) $1.15 \leq x \leq 1.3 (\pm 0.02)$ | 6. 3.3 |

page 224 Exercise 9

- | | | |
|------------------|-----------------------------|---|
| 1. (a) 180 | (b) $C = 0.2x + 35$ | |
| 2. (a) 30 litres | (b) 6 km/litre; 30 km/litre | (c) $6\frac{2}{3} \text{ km/litre; 6 litres}$ |
| 3. (a) 2000 | (b) 200 | (c) $1.6 \leq x \leq 2.4$ |
| 4. (a) Yes | (b) No | (c) About \$250-\$270 |

page 226 Exercise 10

- | | | | |
|-----------------------|-------------------------|----------------------|--------------------------|
| 1. (a) -0.4, 2.4 | (b) -0.8, 3.8 | (c) -1, 3 | (d) -0.4, 2.4 |
| 2. -0.3, 3.3 | 3. 0.6, 3.4 | 4. 0.3, 3.7 | |
| 5. (a) $y = 3$ | (b) $y = -2$ | (c) $y = x + 4$ | (d) $y = x$ |
| 6. (a) $y = 6$ | (b) $y = 0$ | (c) $y = 4$ | (d) $y = 2x$ |
| 7. (a) $y = -4$ | (b) $y = 2x$ | (c) $y = x - 2$ | (d) $y = -3$ |
| 8. (a) $y = 5$ | (b) $y = 2x$ | (c) $y = 0.2$ | (d) $y = 3 - x$ |
| 9. (a) $y = 0$ | (b) $y = -2\frac{1}{2}$ | (c) $y = -8x$ | (d) $y = -3$ |
| 10. (a) -1.65, 3.65 | (b) -1.3, 2.3 | (c) -1.45, 3.45 | (e) $y = -5\frac{1}{2}x$ |
| 11. (a) 1.7, 5.3 | (b) 0.2, 4.8 | 12. (a) -3.3, 0.3 | (b) -4.6, -0.4 |
| 13. (a) -2.35, 0.85 | (b) -2.8, 1.8 | | |
| 14. (a) (i) -0.4, 2.4 | (ii) -0.5, 2 | (b) $-1.3 < x < 2.8$ | |
| 15. (a) 3.4, -5.4 | (b) 2.4, 7.6 | (c) ± 4.2 | |

16. (a) ± 3.7 (c) ± 2.8 17. (a) 1.75 (b) 0, ± 1.4
 18. (a) $1.6 < x < 7.4$ (b) 6.9
 19. (a) 2.6 (b) 0.45 (c) 0.64 (d) 5.7
 20. (a) $-1.6, 0.6$ (b) $-\frac{1}{2}, 1$

page 230 Exercise 11

1. (a) 45 min (b) 09 : 15 (c) 60 km/h (d) 100 km/h (e) 57.1 km/h
 2. (a) 09 : 15 (b) 64 km/h (c) 37.6 km/h (d) 47 km (e) 80 km/h
 3. 11 : 05 4. 12 : 42 5. 12 : 35 6. $1\frac{1}{8}$ h 7. 1 h
 8. (a) (i) B (ii) A (b) 8 s to 18 s (c) About 15 s
 (d) About 9 s (e) B (f) A

page 232 Exercise 12

1. (a) $1\frac{1}{2}$ m/s² (b) 675 m (c) $11\frac{1}{4}$ m/s (d) -2 m/s²
 2. (a) 600 m (b) 20 m/s (c) 225 m
 3. (a) 600 m (b) $387\frac{1}{2}$ m (c) 0 m/s²
 4. (a) 20 m/s (b) 750 m
 5. (a) 8 s (b) 496 m (c) 12.4 m/s
 6. (a) 30 m/s (b) $-2\frac{1}{7}$ m/s² (c) 20 s
 7. (a) 15 m/s (b) $2\frac{1}{4}$ m/s²
 8. (a) 40 m/s (b) 10 s
 9. (a) 50 m/s (b) 20 s
 10. (a) 20 m/s (b) 20 s

page 234 Exercise 13

1. 225 m 2. 60 m 3. $\frac{2}{3}$ km
 4. 10 s 5. 3 min 6. 50 m
 7. 18.75 m 8. 1.39 km 9. 250 m
 10. Yes. Stopping distance = 46.5 m
 11. 94 375 m
 12. (a) 0.8 m/s² (b) 670 m 13. (a) 0.35 m/s² (b) 260 m

page 235 Revision exercise 7A

1. (a) $y = x - 7$ (b) $y = 2x + 5$ (c) $y = -2x + 10$ (d) $y = \frac{x+1}{2}$
 2. (a) 2 (b) 1 (c) $-3\frac{1}{2}$ (d) 0 (e) 10
 3. (a) 2, -7 (b) -4, 5 (c) $\frac{1}{2}, 4$ (d) $-\frac{1}{2}, 5$ (e) -2, 12 (f) $-\frac{2}{3}, 8$
 4. A : $y = 6$; B : $y = \frac{1}{2}x - 3$; C : $y = 10 - x$; D : $y = 3x$
 5. A : $4y = 3x - 16$; B : $2y = x - 8$; C : $2y + x = 8$; D : $4y + 3x = 16$
 6. (a) $y = 2x - 3$ (b) $y = 3x + 4$ (c) $y = 10 - x$ (d) $y = 7$
 7. (a) A(0, -8), (4, 0) (b) 2 (c) $y = 2x - 8$
 8. 25 sq. units 9. -3 10. 219
 12. (a) $y = 3x$ (b) $y = 0$ (c) $y = 11 - x$ (d) $y = 5x$
 13. (a) 1.56, -2.56 (b) ± 2.24 (c) ± 2.65
 14. (a) 0.84, 4.15 (b) $0.65 < x < 3.85$ (c) 3.3
 15. (a) 9.2 (b) 0.6 (c) 1.4 (d) 1.65
 16. (a) 0.3 m/s² (b) 1050 m (c) 40 s
 17. (a) 30 m/s (b) 600 m

page 238 Examination exercise 7B

- (b) (ii) $y = 2x - 6$ (iii) $(4.3, 2.6), (0.7, -4.6)$ (c) 4 (d) $a = 2, b = -8$
- (a) $p = 2.4, q = 2, r = 1.5, s = 5, t = 9, u = -7$. (c) (ii) 2.8, 7.7 (d) ≈ -4
- (a) $l = 3, m = 5, n = 3.4$ (c) (i) -1.6 (ii) $-0.9, 1.2, 3.7$ (d) ≈ -1.4
- (a) $a = -18, b = 4, c = -8$ (c) (i) 3.5 (ii) -2.9 (e) (ii) 3, 0.73, -2.73
- (a) $3\frac{1}{2}$ min (b) 3 km/min^2 (c) (i) $\frac{3}{8} \text{ km}$ (ii) $6\frac{3}{8} \text{ km}$
- (b) $\frac{4}{3} \text{ m/s}^2$ (c) 150 m
- (b) (i) $f(8) = 49.8, f(9) = 49.9$ (ii) 50 (c) (i) 8.5 (ii) acceleration
(d) (ii) $0.5 < t < 6.5$ (iii) first particle – area under graph greater

8 Sets, Vectors and Functions

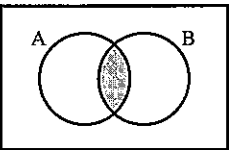
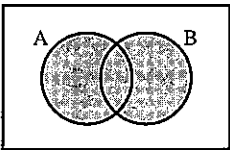
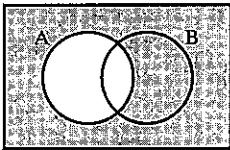
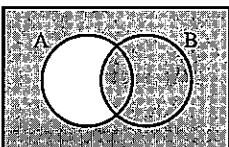
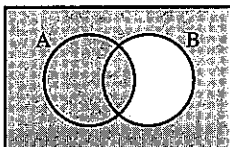
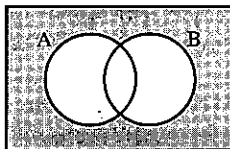
page 242 Exercise 1

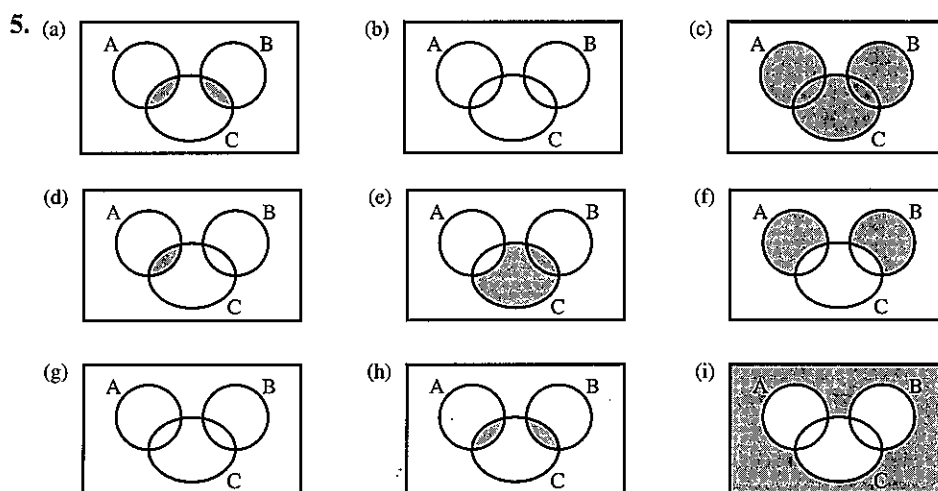
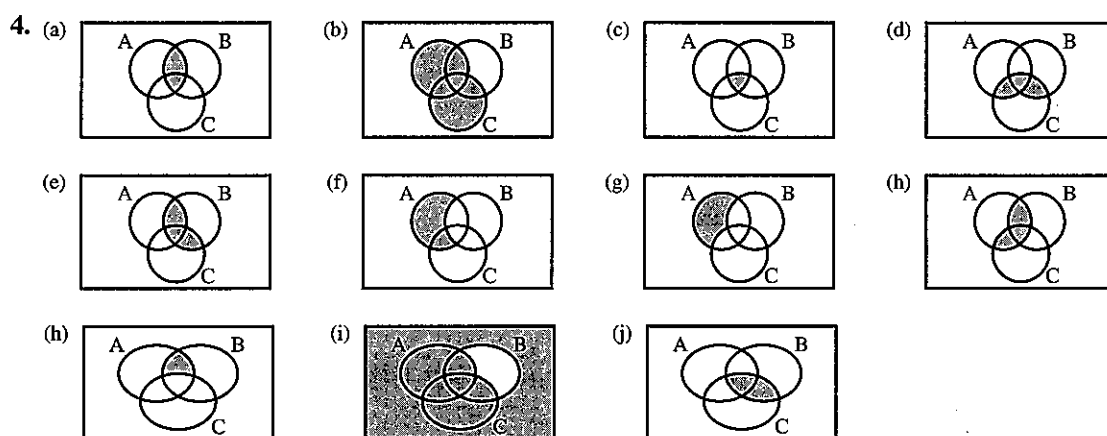
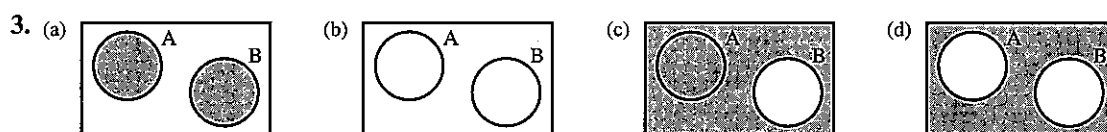
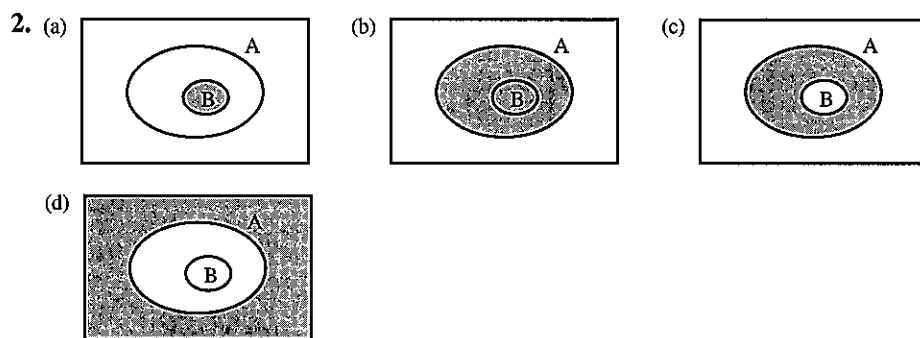
- (a) 8 (b) 3 (c) 4 (d) 18 (e) 7
- (a) 9 (b) 5 (c) 4 (d) 20 (e) 31
- (a) 8 (b) 3 (c) 3 (d) 2 (e) 18 (f) 0
- (a) 59 (b) 11 (c) 5 (d) 40 (e) 11 (f) 124
- (a) 120 (b) 120 (c) 490 (d) 80 (e) 40 (f) 10 (g) 500

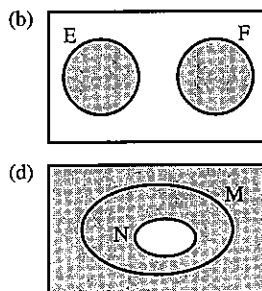
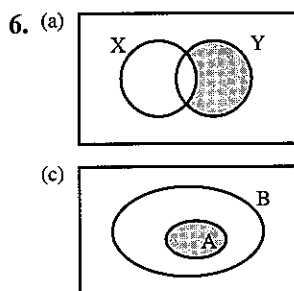
page 244 Exercise 2

- (a) $\{5, 7\}$ (b) $\{1, 2, 3, 4, 5, 6, 7, 8, 9, 11, 13\}$ (c) 5 (d) 11
(e) true (f) true (g) false (h) true
- (a) $\{2, 3, 5, 7\}$ (b) $\{1, 2, 3, \dots, 9\}$ (c) 4 (d) \emptyset (e) false
(f) true (g) false (h) true
- (a) $\{2, 4, 6, 8, 10\}$ (b) $\{16, 18, 20\}$ (c) \emptyset (d) 15 (e) 11
(f) 21 (g) false (h) false (i) true (j) true
- (a) $\{1, 3, 4, 5\}$ (b) $\{1, 5\}$ (c) 1 (d) $\{1, 5\}$ (e) $\{1, 3, 5, 10\}$
(f) 4 (g) true (h) false (i) true
- (a) 4 (b) 3 (c) $\{b, d\}$ (d) $\{a, b, c, d, e\}$ (e) 5
(f) 2
- (a) 2 (b) 4 (c) $\{1, 2, 4, 6, 7, 8, 9\}$ (d) $\{7, 9\}$
(e) $\{1, 2, 4\}$ (f) $\{1, 2, 4, 7, 9\}$ (g) $\{1, 2, 4, 6, 8\}$ (h) $\{6, 7, 8, 9\}$ (i) $\{1, 2, 4, 7, 9\}$

page 245 Exercise 3

- (a)  (b)  (c) 
(d)  (e)  (f) 



7. (a) $A \cup B$ (b) $A' \cap B$ (c) $(A \cup B)'$ (d) $X' \cap Y$

page 247 Exercise 4

1. (a) $10 - x$ (b) $13 - x$ (d) 5 2. 9 3. 14 4. 3
 5. 36 6. 3 7. 11 8. 5 9. 28 10. $x = 6$; 26
 11. 34 12. (a) 12 (b) $\frac{1}{2}$ 13. $x = 10$; 30 14. 2
15. (a) All good footballers are Scottish men. (b) No good footballers are Scottish men.
 (c) There are some good footballers who are Scottish men.
16. (a) The football players are all boys. (b) The hockey players are all girls.
 (c) There are some people who play both football and hockey.
 (d) There are no boys who play hockey. (e) $B \cap F = \emptyset$ (f) $H \cup F = \mathcal{E}$
17. (a) $S \cap T = \emptyset$ (b) $F \subset T$ (c) $S \cap F \neq \emptyset$
 (d) All living creatures are either spiders, animals that fly or animals which taste nice.
 (e) Animals which taste nice are all spiders.
18. (a) All tigers who believe in fairies also believe in Eskimos.
 (b) All tigers who believe in fairies or Eskimos are in hospital.
 (c) There are no tigers in hospital who believe in Eskimos.
 (d) $H \subset T$ (e) $T \cap X \neq \emptyset$
19. (a) There are no good bridge players called Peter.
 (b) All school teachers are either called Peter, are good bridge players or are women.
 (c) There are some women teachers called Peter.
 (d) $W \cap B = \emptyset$ (e) $B \subset (W \cap P)$

page 251 Exercise 5

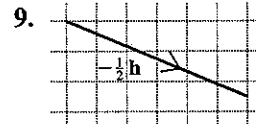
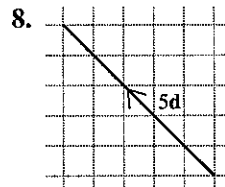
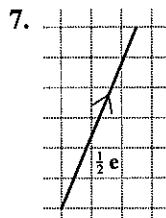
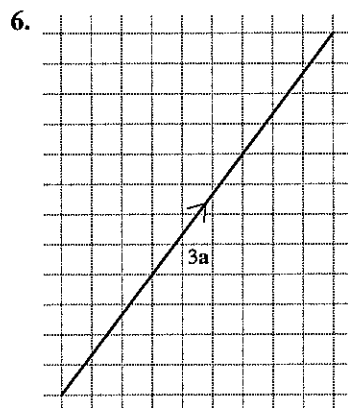
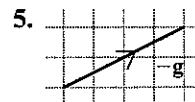
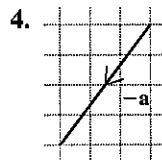
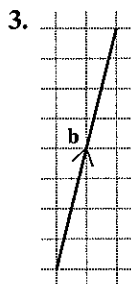
1. d 2. $2c$ 3. $3c$ 4. $3d$ 5. $5d$
 6. $3c$ 7. $-2d$ 8. $-2c$ 9. $-3c$ 10. $-c$
 11. $c + d$ 12. $c + 2d$ 13. $2c + d$ 14. $3c + d$ 15. $2c + 2d$
 16. $2c + 3d$ 17. $2c - d$ 18. $3c - d$ 19. $-c + 2d$ 20. $-c + 3d$
 21. $-c + d$ 22. $-c - 2d$ 23. $-2c - 2d$ 24. $-3c - 6d$ 25. $-2c + 3d$
 26. $c + 6d$ 27. \overrightarrow{QI} 28. \overrightarrow{QU} 29. \overrightarrow{QH} 30. \overrightarrow{QB}
 31. \overrightarrow{QF} 32. \overrightarrow{QJ} 33. \overrightarrow{QZ} 34. \overrightarrow{QL} 35. \overrightarrow{QE}
 36. \overrightarrow{QX} 37. \overrightarrow{QW} 38. \overrightarrow{QK}
39. (a) $-a$ (b) $b - a$ (c) $-b$ (d) $a + b$
 40. (a) $a + b$ (b) $a - 2b$ (c) $-a + b$ (d) $-a - b$
 41. (a) $-a - b$ (b) $3a - b$ (c) $2a - b$ (d) $-2a + b$
 42. (a) $a - 2b$ (b) $a - b$ (c) $2a$ (d) $-2a + 3b$
 43. (a) $-3a + 2b$ (b) $3a - b$ (c) $4a - b$ (d) $-4a + b$
 44. (a) $2a - c$ (b) $2a - c$ (c) $3a$ (d) $a + b + c$ (e) $-3a - b$

45. (a) $b - c$ (b) $2b + 2c$ (c) $a + 2b + 2c$ (d) $-a - b$ (e) $c - a - b$
 46. (a) $a + c$ (b) $-a + c$ (c) $a + b + c$ (d) $b - c$ (e) $-a + 2c$

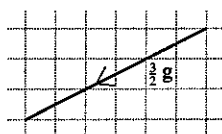
page 253 Exercise 6

1. (a) a (b) $-a + b$ (c) $2b$ (d) $-2a$ (e) $-2a + 2b$
 (f) $-a + b$ (g) $a + b$ (h) b (i) $-b + 2a$ (j) $-2b + a$
 2. (a) a (b) $-a + b$ (c) $3b$ (d) $-2a$ (e) $-2a + 3b$
 (f) $-a + \frac{3}{2}b$ (g) $a + \frac{3}{2}b$ (h) $\frac{3}{2}b$ (i) $-b + 2a$ (j) $-3b + a$
 3. (a) $2a$ (b) $-a + b$ (c) $2b$ (d) $-3a$ (e) $-3a + 2b$
 (f) $-\frac{3}{2}a + b$ (g) $\frac{3}{2}a + b$ (h) $\frac{1}{2}a + b$ (i) $-b + 3a$ (j) $-2b + a$
 4. (a) $\frac{1}{2}a$ (b) $-a + b$ (c) $4b$ (d) $-\frac{3}{2}a$ (e) $-\frac{3}{2}a + 4b$
 (f) $-a + \frac{8}{3}b$ (g) $\frac{1}{2}a + \frac{8}{3}b$ (h) $-\frac{1}{2}a + \frac{8}{3}b$ (i) $\frac{3}{2}a - b$ (j) $a - 4b$
 5. (a) $5a$ (b) $b - a$ (c) $\frac{3}{2}b$ (d) $-6a$ (e) $\frac{3}{2}b - 6a$
 (f) $b - 4a$ (g) $2a + b$ (h) $a + b$ (i) $6a - b$ (j) $a - \frac{3}{2}b$
 6. (a) $4a$ (b) $b - a$ (c) $3b$ (d) $-5a$ (e) $3b - 5a$
 (f) $\frac{3}{4}b - \frac{5}{4}a$ (g) $\frac{15}{4}a + \frac{3}{4}b$ (h) $\frac{11}{4}a + \frac{3}{4}b$ (i) $5a - b$ (j) $a - 3b$
 7. $\frac{1}{2}s - \frac{1}{2}t$ 8. $\frac{1}{3}a + \frac{2}{3}b$ 9. $a + c - b$ 10. $2m + 2n$
 11. (a) $b - a$ (b) $b - a$ (c) $2b - 2a$ (d) $b - 2a$ (e) $b - 2a$
 (f) $2b - 3a$
 12. (a) $y - z$ (b) $\frac{1}{2}y - \frac{1}{2}z$ (c) $\frac{1}{2}y + \frac{1}{2}z$ (d) $-x + \frac{1}{2}y + \frac{1}{2}z$ (e) $-\frac{2}{3} + \frac{1}{3}y + \frac{1}{3}z$
 (f) $\frac{1}{3}x + \frac{1}{3}y + \frac{1}{3}z$

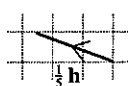
page 257 Exercise 7



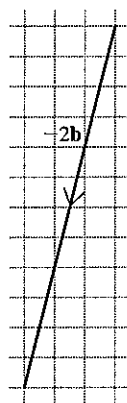
10.



11.



12.

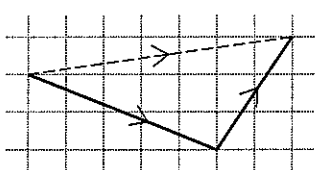


13. $\begin{pmatrix} -11 \\ 9 \end{pmatrix}$ 14. $\begin{pmatrix} -1 \\ -4 \end{pmatrix}$ 15. $\begin{pmatrix} 4 \\ 8 \end{pmatrix}$ 16. $\begin{pmatrix} 4 \\ 3 \end{pmatrix}$ 17. $\begin{pmatrix} 8 \\ -7 \end{pmatrix}$ 18. $\begin{pmatrix} 18 \\ -1 \end{pmatrix}$ 19. $\begin{pmatrix} 7 \\ -4 \end{pmatrix}$ 20. $\begin{pmatrix} -18 \\ -16 \end{pmatrix}$
 21. $\begin{pmatrix} 13 \\ 19 \end{pmatrix}$ 22. $\begin{pmatrix} 8 \\ 5 \end{pmatrix}$ 23. $\begin{pmatrix} 10 \\ -13 \end{pmatrix}$ 24. $\begin{pmatrix} 17 \\ 35 \end{pmatrix}$ 25. $\begin{pmatrix} 4 \\ 8 \end{pmatrix}$ 26. $\begin{pmatrix} 4 \\ 3 \end{pmatrix}$ 27. $\begin{pmatrix} -1 \\ 1 \end{pmatrix}$ 28. $\begin{pmatrix} -16 \\ 3 \end{pmatrix}$
 29. $\begin{pmatrix} -2\frac{1}{2} \\ -3 \end{pmatrix}$ 30. $\begin{pmatrix} -3\frac{1}{2} \\ \frac{1}{2} \end{pmatrix}$ 31. $\begin{pmatrix} -3 \\ -7 \end{pmatrix}$ 32. $\begin{pmatrix} -2 \\ 12 \end{pmatrix}$ 33. $\begin{pmatrix} 4 \\ 8 \end{pmatrix}$ 34. $\begin{pmatrix} -5\frac{1}{2} \\ 4\frac{1}{2} \end{pmatrix}$ 35. $\begin{pmatrix} 0 \\ 0 \end{pmatrix}$ 36. $\begin{pmatrix} -2\frac{1}{2} \\ -6 \end{pmatrix}$

37. (b) l and s; n and r; p and t; m and q

38. (a) true (b) true (c) true

39. (a)

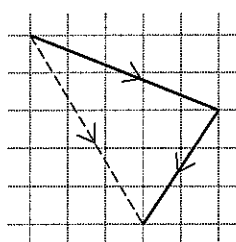


(d) true

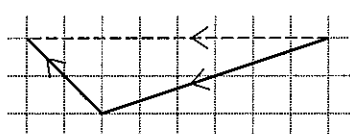
(e) false

(f) false

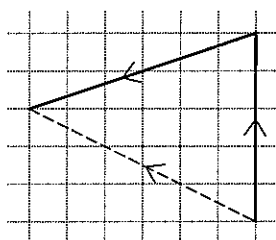
(b)



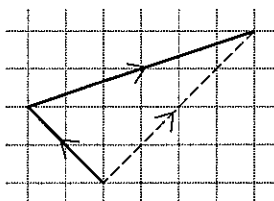
40. (a)



(b)



(c)



(d)



page 258 Exercise 8

1. $\begin{pmatrix} 2 \\ -2 \end{pmatrix}$
2. $\begin{pmatrix} 6 \\ -2 \end{pmatrix}$
3. (b) $\begin{pmatrix} 0 \\ 3 \end{pmatrix}; \begin{pmatrix} -5 \\ -5 \end{pmatrix}$
4. (b) $\begin{pmatrix} 4 \\ 2 \end{pmatrix}; \begin{pmatrix} -7 \\ 0 \end{pmatrix}$
5. (a) $\begin{pmatrix} 3 \\ -3 \end{pmatrix}$
- (b) $\begin{pmatrix} 1\frac{1}{2} \\ -1\frac{1}{2} \end{pmatrix}$
- (c) $\begin{pmatrix} 3\frac{1}{2} \\ 3\frac{1}{2} \end{pmatrix}; M(3\frac{1}{2}, 3\frac{1}{2})$
6. (a) $\begin{pmatrix} -1 \\ 6 \end{pmatrix}$
- (b) $\begin{pmatrix} -\frac{1}{2} \\ 3 \end{pmatrix}$
- (c) $\begin{pmatrix} 5\frac{1}{2} \\ -4 \end{pmatrix}; M(5\frac{1}{2}, -4)$
7. (a) (i) $\begin{pmatrix} -6 \\ 3 \end{pmatrix}$ (ii) $\begin{pmatrix} -2 \\ 1 \end{pmatrix}$ (iii) $\begin{pmatrix} 2 \\ 3 \end{pmatrix}$
- (b) (i) $\begin{pmatrix} 0 \\ -9 \end{pmatrix}$ (ii) $\begin{pmatrix} 0 \\ -3 \end{pmatrix}$ (iii) $\begin{pmatrix} -2 \\ 2 \end{pmatrix}$
8. $\begin{pmatrix} 1 \\ -2 \end{pmatrix}$ or $\begin{pmatrix} -1 \\ 2 \end{pmatrix}$
9. $\begin{pmatrix} 0 \\ 2 \end{pmatrix}$ or $\begin{pmatrix} 0 \\ -2 \end{pmatrix}$
10. (a) $\mathbf{q} - \mathbf{p}$
- (b) $\mathbf{q} + 2\mathbf{p}$
- (c) $\mathbf{p} + \mathbf{q}$
11. (a) $\begin{pmatrix} 1 \\ -3 \end{pmatrix}$
- (b) $\begin{pmatrix} -1 \\ 3 \end{pmatrix}$
- (c) $\begin{pmatrix} 3 \\ 1 \end{pmatrix}$
- (d) $\begin{pmatrix} -3 \\ -1 \end{pmatrix}$

page 260 Exercise 9

1. 5
2. $\sqrt{17}$
3. 13
4. 3
5. 5
6. $\sqrt{45}$
7. $\sqrt{74}$
8. $\sqrt{208}$
9. 10
10. $\sqrt{89}$
11. (a) $\sqrt{320}$
- (b) no
12. (a) $\sqrt{148}$
- (b) no
13. $\sqrt{29}$
14. $\sqrt{26}$
15. $\sqrt{10}$
16. (a) 5
- (b) $n = \pm 4$
17. (a) 13
- (b) $m = \pm 13$
18. (a) 5
- (b) $p = 0$
19. (a) 9
- (b) 6
- (c) 5
20. (a) 30
- (b) 5
- (c) $\sqrt{50}$
- (d) 4

page 262 Exercise 10

1. (a) $2\mathbf{a}; 3\mathbf{b}$
- (b) $-\mathbf{b} + \mathbf{a}$
- (c) $-3\mathbf{b} + 2\mathbf{a}$
- (d) $4\mathbf{a} - 3\mathbf{b}$
- (e) $4\mathbf{a} - 6\mathbf{b}$
- (f) $\overrightarrow{EC} = 2\overrightarrow{ED}$
2. (a) $2\mathbf{b}; \frac{5}{2}\mathbf{a}$
- (b) $-\mathbf{a} + \mathbf{b}$
- (c) $-\frac{5}{2}\mathbf{a} + 2\mathbf{b}$
- (d) $-5\mathbf{a} + 6\mathbf{b}$
- (e) $-\frac{15}{2}\mathbf{a} + 6\mathbf{b}$
- (f) $\overrightarrow{XC} = 3\overrightarrow{XY}$
3. (a) $-\mathbf{b} + \mathbf{a}; -3\mathbf{b} + 3\mathbf{a}$
- (b) $-2\mathbf{b} + \frac{3}{2}\mathbf{a}$
- (c) $-\frac{1}{2}\mathbf{a}; -2\mathbf{b} + \frac{3}{2}\mathbf{a}$
- (d) $\overrightarrow{MX} = 3\overrightarrow{MP}$
4. (a) $-\mathbf{a} + \mathbf{b}; -\frac{2}{3}\mathbf{a} + \frac{2}{3}\mathbf{b}$
- (b) $\frac{1}{2}\mathbf{a}; -\frac{1}{6}\mathbf{a} + \frac{2}{3}\mathbf{b}$
- (c) $-\frac{1}{2}\mathbf{a} + 2\mathbf{b}$
- (d) $k = \frac{3}{2}$
5. (a) $-\mathbf{b} + \mathbf{a}; -3\mathbf{a} + \mathbf{b}$
- (b) $-\frac{3}{2}\mathbf{a} + \frac{1}{2}\mathbf{b}$
- (c) $(k - \frac{3}{2})\mathbf{a} + (\frac{1}{2} - k)\mathbf{b}$
- (d) $m = \frac{4}{3}$
6. (a) $-\mathbf{a} + \mathbf{b}$
- (b) $-\frac{1}{4}\mathbf{a} + \frac{1}{4}\mathbf{b}$
- (c) $\mathbf{a} + (m - 1)\mathbf{b}$
- (d) $\mathbf{c} + (n - 1)\mathbf{d}$
7. (a) $-\mathbf{c} + \mathbf{d}$
- (b) $-\frac{1}{3}\mathbf{c} + \frac{1}{3}\mathbf{d}$
- (c) $\frac{4}{5}\mathbf{c} + \frac{1}{5}\mathbf{d}$
- (d) $\mathbf{c} + (n - 1)\mathbf{d}$
- (e) $n = \frac{5}{4}$
8. (a) $-\mathbf{a} + \mathbf{b}; -\frac{1}{2}\mathbf{a} + \frac{1}{2}\mathbf{b}; \frac{1}{2}\mathbf{a} + \frac{1}{2}\mathbf{b}$
- (b) $\frac{1}{3}\mathbf{a} + \frac{1}{3}\mathbf{b}$
- (c) $-\frac{2}{3}\mathbf{a} + \frac{1}{3}\mathbf{b}$
- (d) $-\mathbf{a} + \frac{1}{2}\mathbf{b}$
- (e) $m = \frac{2}{3}$
9. (a) $-\mathbf{a} + \mathbf{b}$
- (b) $\frac{1}{2}\mathbf{b}$
- (c) $-\mathbf{a} + \mathbf{c}$
- (d) $-\frac{1}{2}\mathbf{a} + \frac{1}{2}\mathbf{c}$
- (e) $\frac{1}{2}\mathbf{a} + \frac{1}{2}\mathbf{c}$
- (f) $-\frac{1}{2}\mathbf{b} + \frac{1}{2}\mathbf{a} + \frac{1}{2}\mathbf{c}$
- (g) $\mathbf{a} + \mathbf{c} = \mathbf{b}$
10. (a) $-\mathbf{b} + \mathbf{a}$
- (b) $m\mathbf{a} + (1 - m)\mathbf{b}$
- (c) $4\mathbf{a} + 2\mathbf{b}$
- (d) $n = \frac{1}{6}, m = \frac{2}{3}$
11. (a) $-\mathbf{c} + \mathbf{d}; -\frac{1}{4}\mathbf{c} + \frac{1}{4}\mathbf{d}; \frac{3}{4}\mathbf{c} + \frac{1}{4}\mathbf{d}$
- (b) $-\mathbf{c} + \frac{1}{2}\mathbf{d}$
- (c) $(1 - h)\mathbf{c} + \frac{h}{2}\mathbf{d}$
- (d) $(1 - h)\mathbf{c} + \frac{h}{2}\mathbf{d} = k; \frac{3}{4}\mathbf{c} + \frac{k}{4}\mathbf{d}; h = \frac{2}{5}, k = \frac{4}{5}$

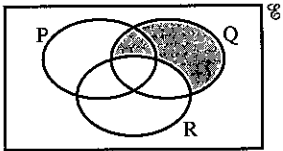
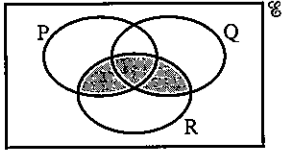
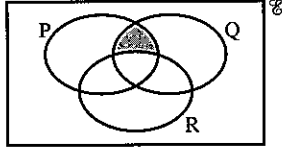
page 265 Exercise 11

1. (a) 5, 10, 1 (b) 21, 101, -29
2. $x \rightarrow \boxed{\times 5} \rightarrow \boxed{+4} \rightarrow 5x + 4$
3. $x \rightarrow \boxed{-4} \rightarrow \boxed{\times 3} \rightarrow 3(x - 4)$
4. $x \rightarrow \boxed{\times 2} \rightarrow \boxed{+7} \rightarrow \boxed{\text{square}} \rightarrow (2x + 7)^2$
5. $x \rightarrow \boxed{\times 5} \rightarrow \boxed{+9} \rightarrow \boxed{\div 4} \rightarrow \frac{5x + 9}{4}$
6. $x \rightarrow \boxed{\times -3} \rightarrow \boxed{\text{subtract from 4}} \rightarrow \boxed{\div 5} \rightarrow \frac{4 - 3x}{5}$
7. $x \rightarrow \boxed{\text{square}} \rightarrow \boxed{\times 2} \rightarrow \boxed{+1} \rightarrow 2x^2 + 1$
8. $x \rightarrow \boxed{\text{square}} \rightarrow \boxed{\times 3} \rightarrow \boxed{\div 2} \rightarrow \boxed{+5} \rightarrow \frac{3x^2}{2} + 5$
9. $x \rightarrow \boxed{\times 4} \rightarrow \boxed{-5} \rightarrow \boxed{\text{square root}} \rightarrow \sqrt{4x - 5}$
10. $x \rightarrow \boxed{\text{square}} \rightarrow \boxed{+10} \rightarrow \boxed{\text{square root}} \rightarrow \boxed{\times 4} \rightarrow 4\sqrt{x^2 + 10}$
11. $x \rightarrow \boxed{\times 3} \rightarrow \boxed{\text{subtract from 7}} \rightarrow \boxed{\text{square}} \rightarrow (7 - 3x)^2$
12. $x \rightarrow \boxed{\times 3} \rightarrow \boxed{+1} \rightarrow \boxed{\text{square}} \rightarrow \boxed{\times 4} \rightarrow \boxed{+5} \rightarrow 4(3x + 1)^2 + 5$
13. $x \rightarrow \boxed{\text{square}} \rightarrow \boxed{\text{subtract from 5}} \rightarrow 5 - x^2$
14. $x \rightarrow \boxed{\text{square}} \rightarrow \boxed{+1} \rightarrow \boxed{\text{square root}} \rightarrow \boxed{\times 10} \rightarrow \boxed{+6} \rightarrow \boxed{\div 4} \rightarrow \frac{10\sqrt{x^2 + 1} + 6}{4}$
15. $x \rightarrow \boxed{\text{cube}} \rightarrow \boxed{\div 4} \rightarrow \boxed{+1} \rightarrow \boxed{\text{square}} \rightarrow \boxed{\text{subtract 6}} \rightarrow \left(\frac{x^3}{4} + 1\right)^2 - 6$
16. (a) -9, 11, $\frac{1}{2}$ (b) 0.8, -2.7, $\frac{1}{80}$ (c) 4, 1.2, 36
17. (a) 0 (b) 6 (c) 12
18. (a) 10 (b) $\frac{1}{2}$ (c) 2
19. (a) 6, 24, 6 (b) 0, $\sqrt{2}$, $\sqrt{6}$ (c) -6, 6, $9\frac{3}{4}$
20. (a) ± 3 (b) ± 3 (c) ± 2 (d) ± 6
21. (a) 10, 21 (b) 111, 411, 990, 112
22. (a) 7 (b) 10 (c) 5 (d) 14
(e) 7 (f) 7
23. (a) 3 (b) 6 (c) 8 (d) 10
24. (a) 11 (b) 17 (c) 7
25. (a) 5 (b) 17 (c) $1\frac{1}{2}$ (d) 3
26. $a = 3, b = 5$ 27. $a = 2, b = -5$ 28. $a = 7, b = 1$

page 268 Exercise 12

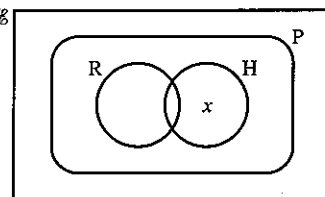
1. (a) $x \mapsto 4(x+5)$ (b) $x \mapsto 4x+5$ (c) $x \mapsto (4x)^2$ (d) $x \mapsto 4x^2$
 (e) $x \mapsto x^2+5$ (f) $x \mapsto 4(x^2+5)$ (g) $x \mapsto [4(x+5)]^2$
2. (a) -2.5 (b) $\pm\sqrt{\frac{5}{3}}$
3. (a) $x \mapsto 2(x-3)$ (b) $x \mapsto 2x-3$ (c) $x \mapsto x^2-3$ (d) $x \mapsto (2x)^2$
 (e) $x \mapsto (2x)^2-3$ (f) $x \mapsto (2x-3)^2$
4. (a) 2 (b) 11 (c) 6 (d) 2
 (e) 1 (f) 64
5. (a) -3 (b) 2 (c) $1\frac{1}{2}$ (d) 5
6. (a) $x \mapsto 2(3x-1)+1$ (b) $x \mapsto 3(2x+1)-1$ (c) $x \mapsto 2x^2+1$ (d) $x \mapsto (3x-1)^2$
 (e) $x \mapsto 2(3x-1)^2+1$ (f) $x \mapsto 3(2x^2+1)-1$
7. (a) 11 (b) 9 (c) 11 (d) 14
 (e) 81 (f) -1
8. (a) 2 (b) 0, 2 (c) $\pm\sqrt{2}$
9. $x \mapsto \frac{x+2}{5}$ 10. $x \mapsto \frac{x}{5}+2$ 11. $x \mapsto \frac{x}{6}-2$ 12. $x \mapsto \frac{3x-1}{2}$
13. $x \mapsto \frac{4x}{3}+1$ 14. $x \mapsto \frac{x-2}{6}$ 15. $x \mapsto \frac{2x-24}{5}$ 16. $x \mapsto \frac{x-3}{-7}$
17. $x \mapsto \frac{3x-12}{-5}$ 18. $x \mapsto 10-3x$ 19. $x \mapsto \frac{4(5x+3)+1}{2}$ 20. $x \mapsto \frac{7x-30}{6}$
21. $x \mapsto 20x-164$
22. (a) \sqrt{x} (b) \log (c) $x!$ (d) x^2 (e) $\frac{1}{x}$ (f) \tan (g) $\frac{1}{x}$ (h) $\sqrt{\quad}$ (i) \cos
 (j) \log or \ln (k) \tan (l) $x!$ (m) \cos (n) \sin (o) \cos (p) $\frac{1}{x}$ (q) $x!$ (r) \log

page 270 Revision exercise 8A

1. (a) $\{5\}$ (b) $\{1, 3, 5, 6, 7\}$ (c) $\{2, 4, 6, 7, 8\}$ (d) $\{2, 4, 8\}$ (e) $\{1, 2, 3, 4, 5, 8\}$ 2. 32
3. (a)  (b)  (c) 
4. (a) $(A \cup B)' \cap C$ (b) $(A \cup B) \cap C'$
5. (a) (i) $S \subset T$ (ii) $S \cap M' \neq \emptyset$ (b) There are no women on the train over 25 years old.
6. (a) 4 (b) 11 (c) 17 7. (a) $\mathbf{r} - \mathbf{p}$ (b) $\frac{1}{2}\mathbf{p} - \frac{1}{2}\mathbf{p}$ (c) $\frac{1}{2}\mathbf{r} + \frac{1}{2}\mathbf{p}$
8. (a) 5 (b) $\sqrt{68}$ (c) $\sqrt{41}$ 9. $n = 2, m = -15$
10. (a) $\begin{pmatrix} -1 \\ 4 \end{pmatrix}$ (b) $\begin{pmatrix} 4 \\ 4 \end{pmatrix}$ (c) $\begin{pmatrix} 6 \\ -4 \end{pmatrix}$ (d) $\begin{pmatrix} 2 \\ 2 \end{pmatrix}$
11. (a) $\mathbf{a} - \mathbf{c}$ (b) $\frac{1}{2}\mathbf{a} + \mathbf{c}$ (c) $\frac{1}{2}\mathbf{a} - \frac{1}{2}\mathbf{c}$ CA is parallel to NM and $CA = 2NM$.
12. $m = 3, n = 2$ 13. (a) $\begin{pmatrix} -3 \\ 2 \end{pmatrix}$ (b) $\begin{pmatrix} -1\frac{1}{2} \\ 1 \end{pmatrix}$ (c) $\begin{pmatrix} 1\frac{1}{2} \\ 3 \end{pmatrix}$
14. (a) -5 (b) 0 (c) -3 (d) 8; $ff: x \mapsto 4x - 9$
15. $f^{-1}: x \mapsto \frac{(x-4)}{3}; h^{-1}: x \mapsto 5x+2$ (a) 3 (b) $5\frac{1}{3}$ 16. (a) 3 (b) 0, 5

page 271 Examination exercise 8B

1. (a) 5 (b) $\{3, 4, 5\}$ 2. (a) squares (b) + (c) $\%$
3. (a) $\{3\}$ (b) $\{2, 3, 5, 6, 7, 9\}$ (c) $\{4, 8, 10\}$
4. (a) $\begin{pmatrix} 4 \\ 1 \end{pmatrix}$ (b) $\begin{pmatrix} 5 \\ 2 \end{pmatrix}$ (c) $\sqrt{13}$
5. (a) (i) $\frac{1}{2}a$ (ii) $b - a$ (iii) $3(b - a)$ (iv) $3b - 2\frac{1}{2}a$ (v) $3b - 2a$ (b) (i) $\frac{3}{5}b$ (ii) $3:2$
6. (a) $3\frac{1}{2}$ (b) 8 (c) $\frac{x^2 - 1}{3}$
7. (a) (i) 84 (ii) -12 (b) $\frac{x-2}{5}$ (c) $25x^2 + 20x - 12$ (d) 7.42 or -2.42
8. (a) $\frac{7}{12}$ (c) $\frac{7}{12}$ 9. $\begin{pmatrix} -4 \\ -7 \end{pmatrix}$



9 Matrices and Transformations

page 275 Exercise 1

1. $\begin{pmatrix} 2 & 4 \\ 4 & 2 \end{pmatrix}$ 2. $\begin{pmatrix} 1 & 6 & -1 \\ 7 & -10 & 6 \end{pmatrix}$ 3. — 4. $\begin{pmatrix} -4 & 2 \\ 0 & 0 \end{pmatrix}$
5. $\begin{pmatrix} 8 & 10 \end{pmatrix}$ 6. $\begin{pmatrix} 0 & 15 \\ 3 & -6 \end{pmatrix}$ 7. $\begin{pmatrix} 0 & -3 \\ 1 & 0 \\ -9 & -5 \end{pmatrix}$ 8. $\begin{pmatrix} 4 & 3 \\ 7 & 6 \end{pmatrix}$
9. — 10. $\begin{pmatrix} 6 & 7 \\ 5 & 0 \end{pmatrix}$ 11. $\begin{pmatrix} -1 & 9 \\ -2 & -1 \\ 25 & 10 \end{pmatrix}$ 12. $\begin{pmatrix} 1 & -5\frac{1}{2} \\ \frac{1}{2} & 4 \end{pmatrix}$
13. $\begin{pmatrix} -1 & 12 \\ 4 & 7 \end{pmatrix}$ 14. $\begin{pmatrix} 15 & 20 \\ -4 & -9 \end{pmatrix}$ 15. $\begin{pmatrix} 5 & -10 \\ 2 & 7 \end{pmatrix}$ 16. $\begin{pmatrix} 3 & 14 \\ -2 & 9 \end{pmatrix}$
17. $\begin{pmatrix} 12 \\ 13 \end{pmatrix}$ 18. $\begin{pmatrix} 5 \\ 13 \end{pmatrix}$ 19. $\begin{pmatrix} 14 & 1 \\ -32 & -13 \end{pmatrix}$ 20. $\begin{pmatrix} 8 & -27 \\ 23 & -2 \end{pmatrix}$
21. $\begin{pmatrix} 8 & -27 \\ 23 & -2 \end{pmatrix}$ 22. — 23. — 24. $\begin{pmatrix} 16 & 20 \\ 4 & 5 \\ 12 & 15 \end{pmatrix}$
25. $\begin{pmatrix} 30 & 40 \\ -8 & -18 \end{pmatrix}$ 26. $\begin{pmatrix} 7 \\ 36 \end{pmatrix}$ 27. $\begin{pmatrix} 12 & 15 \\ 4 & 5 \end{pmatrix}$ 28. (17)
29. $\begin{pmatrix} -18 & 14 & -6 \\ 26 & -26 & 8 \end{pmatrix}$ 30. $\begin{pmatrix} 1 & -6 \\ 18 & 13 \end{pmatrix}$ 31. $\begin{pmatrix} -107 & -84 \\ 252 & 61 \end{pmatrix}$ 32. —
33. $\begin{pmatrix} -9 & 13 & -17 \\ 3 & -4 & 5 \\ 0 & -7 & 14 \end{pmatrix}$ 34. $\begin{pmatrix} 59 \\ -21 \end{pmatrix}$ 35. $\begin{pmatrix} 1 & 5 & 1 \\ 3 & -11 & 0 \\ 22 & -20 & 7 \end{pmatrix}$ 36. $\begin{pmatrix} 45 & -140 \\ -28 & 101 \end{pmatrix}$
37. $x = 6, y = 3, z = 0$
39. $a = 4, b = 13, c = 23, d = 2$
41. $m = 5, n = -\frac{1}{3}$
43. $x = 1, y = 2, z = -1, w = -2$
45. $a = -3, e = 4, k = 2$
38. $x = 4, y = 5, z = 7, w = -5, v = 0$
40. $x = 1, y = 4$
42. $p = 3, q = -1$
44. $y = 2, z = -1, x = 1, w = -2$
46. $m = 3, n = 5, p = 3, q = 3$

47. $x = 2\frac{2}{3}$

49. (a) $k = 2$ /

(b) $m = 8$

48. $k = \pm 1$

50. (a) $n = 3$

(b) $q = 9$

page 277 Exercise 2

1. $\begin{pmatrix} 1 & -1 \\ -3 & 4 \end{pmatrix}$

2. $\begin{pmatrix} 5 & -2 \\ -2 & 1 \end{pmatrix}$

3. $\frac{1}{2} \begin{pmatrix} 2 & -4 \\ -1 & 3 \end{pmatrix}$

4. $\frac{1}{3} \begin{pmatrix} 1 & -2 \\ -1 & 5 \end{pmatrix}$

5. $\frac{1}{2} \begin{pmatrix} 2 & 2 \\ 1 & 2 \end{pmatrix}$

6. $\frac{1}{5} \begin{pmatrix} 2 & 3 \\ 1 & 4 \end{pmatrix}$

7. $\frac{1}{8} \begin{pmatrix} 3 & -1 \\ 2 & 2 \end{pmatrix}$

8. $\frac{1}{6} \begin{pmatrix} 4 & 3 \\ -2 & 0 \end{pmatrix}$

9. $\frac{1}{5} \begin{pmatrix} -3 & 2 \\ -1 & -1 \end{pmatrix}$

10. No inverse

11. $\frac{1}{14} \begin{pmatrix} 4 & 2 \\ -1 & 3 \end{pmatrix}$

12. $-\frac{1}{5} \begin{pmatrix} 1 & -1 \\ -2 & -3 \end{pmatrix}$

13. $-\frac{1}{5} \begin{pmatrix} -4 & 3 \\ -1 & 2 \end{pmatrix}$

14. $\frac{1}{7} \begin{pmatrix} 1 & 0 \\ 5 & 7 \end{pmatrix}$

15. $-\frac{1}{6} \begin{pmatrix} -4 & -1 \\ 2 & 2 \end{pmatrix}$

16. $\frac{1}{2} \begin{pmatrix} 3 & -4 \\ -1 & 2 \end{pmatrix}$

17. $-\frac{1}{2} \begin{pmatrix} 1 & 0 \\ -3 & -2 \end{pmatrix}$

18. $\begin{pmatrix} -1 & 3 \\ 0 & -3 \end{pmatrix}$

19. $\begin{pmatrix} 3 & 2 \\ 1 & 3 \end{pmatrix}$

20. $\begin{pmatrix} 2 & -3 \\ 2 & 4 \end{pmatrix}$

21. $\frac{2}{3} \begin{pmatrix} 1 & -1 \\ 2 & 1 \end{pmatrix}$

22. (a) $\begin{pmatrix} 5 & -11 \\ -1 & 3 \end{pmatrix}$

(b) $\frac{1}{2} \begin{pmatrix} 1 & 3 \\ 0 & 2 \end{pmatrix}$

(c) $\frac{1}{2} \begin{pmatrix} 3 & 1 \\ 1 & 1 \end{pmatrix}$

23. $\begin{pmatrix} 1 & -3 \\ 4 & 0 \end{pmatrix}$

24. $\begin{pmatrix} 4 \\ 3 \end{pmatrix}$

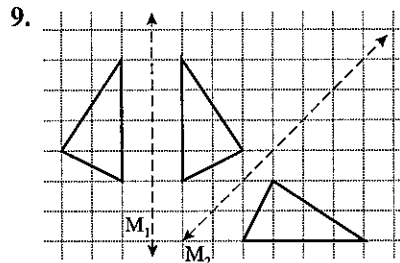
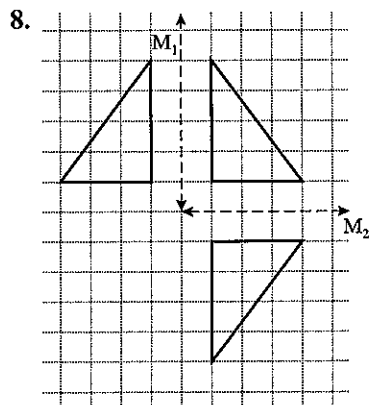
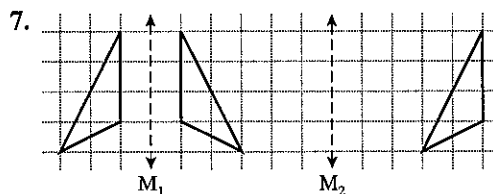
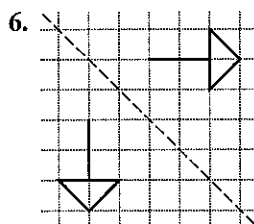
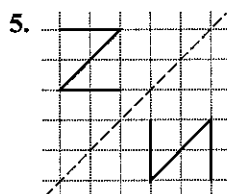
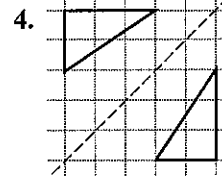
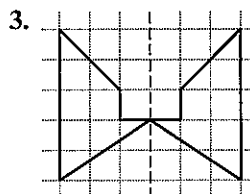
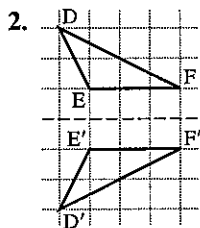
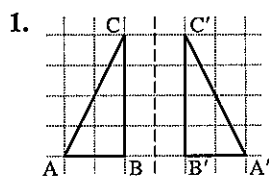
25. 4; $1\frac{1}{2}$

26. $x = -2$

27. (a) 42

(b) 14

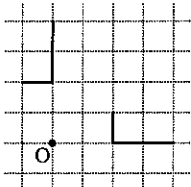
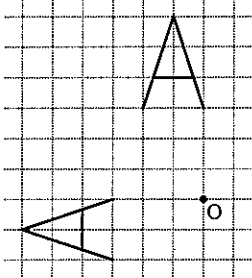
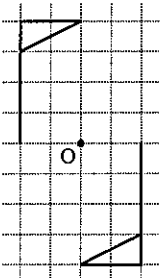
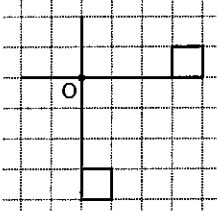
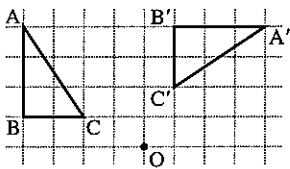
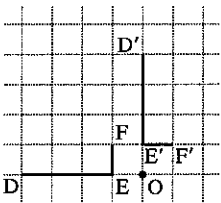
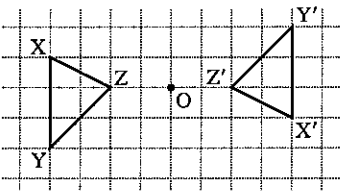
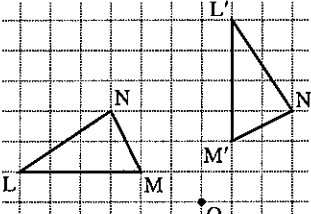
page 279 Exercise 3



page 280 Exercise 4

1. (c) (i) $(-6, 8)$ (ii) $(6, -4)$ (iii) $(8, 6)$
2. (c) (i) $(8, 8)$ (ii) $(8, -6)$ (iii) $(-8, 6)$
3. (c) (i) $(3, -1)$ (ii) $(4, 2)$ (iii) $(-1, 1)$
4. (b) (i) $y = 1$ (ii) $y = x$ (iii) $y = -x$ (iv) $y = 2$
5. (f) $(1, -1), (-3, -1), (-3, -3)$
6. (f) $(8, -2), (6, -6), (6, -6)$

page 282 Exercise 5

1. 
2. 
3. 
4. 
5. 
90° clockwise
6. 
90° clockwise
7. 
180°
8. 
90° clockwise

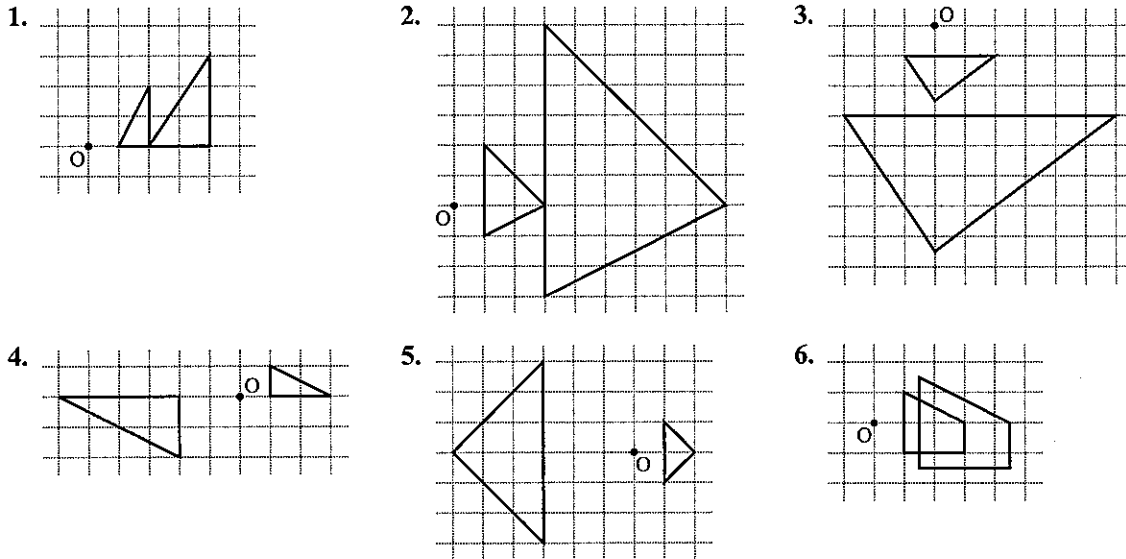
page 283 Exercise 6

1. (a) $A'(3, -1)$ $B'(6, -1)$ $C'(6, -3)$ (b) $D'(3, -3)$ $E'(3, -6)$ $F'(1, -6)$
(c) $P'(-7, -4)$ $Q'(-5, -4)$ $R'(-5, -1)$
2. (b) (i) $(4, -1), (7, -1), (7, -3)$ (ii) $(-1, -4), (-1, -7), (-3, -7)$
(iii) $(-4, 1), (-7, 1), (-7, 3)$
3. (c) $(-2, 1), (-2, -1), (1, -2)$
4. (e) $(-5, 2), (-5, 6), (-3, 5)$
5. (b) (i) 90° anticlockwise, centre $(0, 0)$ (ii) 180°, centre $(2, 1)$
(iii) 90° clockwise, centre $(2, 0)$ (iv) 180°, centre $(3\frac{1}{2}, 2\frac{1}{2})$
(v) 90° anticlockwise, centre $(6, 1)$ (vi) 90° clockwise, centre $(1, 3)$
6. (e) (i) 180°, centre $(\frac{1}{2}, \frac{1}{2})$ (ii) 90° anticlockwise, centre $(-2, 4)$

page 285 Exercise 7

1. (a) $\begin{pmatrix} 7 \\ 3 \end{pmatrix}$ (b) $\begin{pmatrix} 0 \\ -9 \end{pmatrix}$ (c) $\begin{pmatrix} 9 \\ 10 \end{pmatrix}$ (d) $\begin{pmatrix} -10 \\ 3 \end{pmatrix}$
 (e) $\begin{pmatrix} -1 \\ 13 \end{pmatrix}$ (f) $\begin{pmatrix} 10 \\ 0 \end{pmatrix}$ (g) $\begin{pmatrix} -9 \\ -4 \end{pmatrix}$ (h) $\begin{pmatrix} -10 \\ 0 \end{pmatrix}$
 2. (5, 2) 3. (5, 6) 4. (8, -5) 5. (0, 6) 6. (4, -7) 7. (-3, 4)
 8. (-3, -5) 9. (-1, -8) 10. (5, 2) 11. (-2, 1)

page 287 Exercise 8



7. (4, 8), (8, 4), (10, 10)
 10. (1, 4), (7, 8), (11, 2)
 13. (5, 4), -2
 16. (3, 4), (3, 3), (5, 3)
 19. (6, 5), $(3\frac{1}{2}, 5)$, $(3\frac{1}{2}, 3)$
 8. (3, 6), (7, 2), (9, 8)
 11. (2, 1), +3
 14. (6, 6), -1
 17. (3, 7), (1, 7), (3, 3)
 9. (1, 1), (10, 4), (4, 7)
 12. (11, 9), $\frac{1}{2}$
 15. $(\frac{1}{2}, 1)$, $(6\frac{1}{2}, 1)$, $(\frac{1}{2}, 5)$
 18. (10, 7), (6, 7), (6, 5)

page 288 Exercise 9

1. (a) (i) Rotation 90° clockwise, centre (0, -2) (ii) Reflection in $y = x$
 (iii) Translation $\begin{pmatrix} 3 \\ 7 \end{pmatrix}$ (iv) Enlargement, scale factor 2, centre (-5, 5)
 (v) Translation $\begin{pmatrix} -7 \\ -3 \end{pmatrix}$ (vi) Reflection in $y = x$
 2. (a) Rotation 90° clockwise, centre (4, -2) (b) Translation $\begin{pmatrix} 8 \\ 2 \end{pmatrix}$
 (c) Reflection in $y = x$
 (d) Enlargement, scale factor $\frac{1}{2}$, centre (7, -7) (e) Rotation 90° anticlockwise, centre (-8, 0)
 (f) Enlargement, scale factor 2, centre (-1, -9) (g) Rotation 90° anticlockwise, centre (7, 3)

3. (a) Enlargement, scale factor $1\frac{1}{2}$, centre $(1, -4)$ (b) Rotation 90° clockwise, centre $(0, -4)$
 (c) Reflection in $y = -x$ (d) Translation $\begin{pmatrix} 11 \\ 10 \end{pmatrix}$
 (e) Enlargement, scale factor $\frac{1}{2}$, centre $(-3, 8)$ (f) Rotation 90° anticlockwise, centre $(\frac{1}{2}, 6\frac{1}{2})$
 (g) Enlargement, scale factor 3, centre $(-2, 5)$

page 290 Exercise 10

- | | | | | |
|---------------|----------------|----------------|----------------|--------------|
| 1. $(2, -3)$ | 2. $(5, -1)$ | 3. $(6, 4)$ | 4. $(4, -6)$ | 5. $(0, 0)$ |
| 6. $(-6, 4)$ | 7. $(3, -2)$ | 8. $(3, 2)$ | 9. $(-2, 3)$ | 10. $(0, 0)$ |
| 11. $(-3, 2)$ | 12. $(-3, -2)$ | 13. $(-3, -2)$ | 14. $(-6, -4)$ | 15. $(6, 0)$ |
| 16. $(-2, 3)$ | 17. $(0, 4)$ | 18. $(6, 8)$ | 19. $(3, 2)$ | 20. $(0, 0)$ |

page 291 Exercise 11

1. (a) $(-4, 4)$ (b) $(2, -2)$ (c) $(0, 0)$ (d) $(0, 4)$ (e) $(0, 0)$
 2. (a) $(-2, 5)$ (b) $(-4, 0)$ (c) $(2, -2)$ (d) $(1, -1)$
 3. (a) reflection in y -axis (b) rotation 180° , centre $(-2, 2)$
 (c) rotation 90° clockwise, centre $(2, 2)$
 4. (a) rotation 90° anticlockwise, centre $(0, 0)$ (b) translation $\begin{pmatrix} -2 \\ 5 \end{pmatrix}$
 (c) rotation 90° anticlockwise, centre $(2, -4)$
 (d) rotation 90° anticlockwise, centre $(-\frac{1}{2}, 3\frac{1}{2})$
 5. (a) rotation 90° anticlockwise, centre $(2, 2)$ (b) enlargement, scale factor $\frac{1}{2}$, centre $(8, 6)$
 (c) rotation 90° clockwise, centre $(-\frac{1}{2}, -3\frac{1}{2})$
 6. A^{-1} : reflection in $x = 2$
 B^{-1} : B
 C^{-1} : translation $\begin{pmatrix} 6 \\ -2 \end{pmatrix}$
 D^{-1} : D
 E^{-1} : E
 F^{-1} : translation $\begin{pmatrix} -4 \\ -3 \end{pmatrix}$
 G^{-1} : 90° rotation anticlockwise, centre $(0, 0)$
 H^{-1} : enlargement, scale factor 2, centre $(0, 0)$
 7. (a) $(4, 0)$ (b) $(-6, -1)$ (c) $(-2, -2)$ (d) $(2, -2)$ (e) $(6, 2)$
 8. (a) $(1, -6)$ (b) $(4, -2)$ (c) $(2, 7)$ (d) $(4, -6)$ (e) $(2, -4)$
 9. (a) $(-1, -2)$ (b) $(8, 2)$ (c) $(4, -6)$ (d) $(0, -3)$
 10. (b) rotation, 180° , centre $(4, 0)$ (c) translation $\begin{pmatrix} 12 \\ -4 \end{pmatrix}$

page 293 Exercise 12

1. (a) $(-2, 2), (-2, 6), (-4, 6)$ (b) $(-2, 2), (-6, 2), (-6, 4)$ (c) $(2, -2), (6, -2), (6, -4)$
 (d) $(2, 2), (2, 6), (4, 6)$ (e) $(1, 1), (3, 1), (3, 2)$
 2. (a) enlargement: scale factor 2, centre $(0, 0)$ (b) enlargement: scale factor $-\frac{1}{2}$, centre $(0, 0)$
 (c) reflection in $y = -x$ (d) enlargement: scale factor -2 , centre $(0, 0)$
 3. A: reflection in x -axis B: reflection in y -axis C: reflection in $y = x$
 D: rotation, -90° , centre $(0, 0)$ E: reflection in $y = -x$ F: rotation, 180° , centre $(0, 0)$
 G: rotation, $+90^\circ$, centre $(0, 0)$ H: identity (no change)
 4. (b) ratio = 4 : 1
 5. rotation 45° anticlockwise, centre $(0, 0)$; enlargement scale factor $\sqrt{2}$ (1.41)

6. rotation 26.6° clockwise; enlargement scale factor $\sqrt{5}$ (2.24)
 7. (d) rotation 90° clockwise, centre (0, 0)
 8. $y = 2x$
 9. $y = 3x$
 10. (c) $OB = \sqrt{20}$, $OB' = 3\sqrt{20}$ (d) 36.9° (e) rotation 36.9° ; enlargement scale factor 3
 11. (a) $\begin{pmatrix} 0 & -1 \\ 1 & 0 \end{pmatrix}$ (b) $\begin{pmatrix} -1 & 0 \\ 0 & -1 \end{pmatrix}$ (c) $\begin{pmatrix} 0.866 & -0.5 \\ 0.5 & 0.866 \end{pmatrix}$ (d) $\begin{pmatrix} 0 & 1 \\ -1 & 0 \end{pmatrix}$
 (e) $\begin{pmatrix} 0.5 & -0.866 \\ 0.866 & 0.5 \end{pmatrix}$ (f) $\begin{pmatrix} -0.866 & -0.5 \\ 0.5 & -0.866 \end{pmatrix}$ (g) $\begin{pmatrix} 0.707 & -0.707 \\ 0.707 & 0.707 \end{pmatrix}$ (h) $\begin{pmatrix} 0.6 & -0.8 \\ 0.8 & 0.6 \end{pmatrix}$
 12. (a) $+90^\circ$ (b) $+36.9^\circ$ (c) -60° (d) -53.1°

page 295 Exercise 13

1. (a) reflection in $y = x - 1$ (b) reflection in $y = 1$
 (c) rotation -90° , centre (2, -2) (d) enlargement, scale factor 3, centre (2, -1)
 2. (c) $\begin{pmatrix} 0 & -1 \\ -1 & 0 \end{pmatrix}$ (d) $BA \equiv A$ then B 3. (c) $\begin{pmatrix} 2 & 2 \\ 0 & 2 \end{pmatrix}$ (d) $BA \equiv A$ then B
 4. (a) $\begin{pmatrix} \frac{1}{2} & 0 \\ 0 & \frac{1}{2} \end{pmatrix}$ (b) $\begin{pmatrix} 1 & -2 \\ 0 & 1 \end{pmatrix}$ (c) $\frac{1}{3} \begin{pmatrix} 1 & 0 \\ 0 & 3 \end{pmatrix}$
 5. (a) (14, 3) (b) $m = 3$, $n = \frac{1}{2}$ (c) $h = 1$, $k = -2$
 6. (a) (-2, 2) (c) $\begin{pmatrix} 2 \\ -2 \end{pmatrix}$ (d) $\begin{pmatrix} 2 & 0 \\ 0 & 1 \end{pmatrix} \begin{pmatrix} x \\ y \end{pmatrix} + \begin{pmatrix} 2 \\ -2 \end{pmatrix}$
 7. (a) $x = 2$ (c) $\begin{pmatrix} 4 \\ 0 \end{pmatrix}$ (d) $\begin{pmatrix} 2 & 0 \\ 0 & 2 \end{pmatrix} \begin{pmatrix} x \\ y \end{pmatrix} + \begin{pmatrix} 2 \\ -2 \end{pmatrix}$
 8. (a) $\begin{pmatrix} 2 & 0 \\ 0 & 2 \end{pmatrix} \begin{pmatrix} x \\ y \end{pmatrix} + \begin{pmatrix} -1 \\ -3 \end{pmatrix}$ (b) $\begin{pmatrix} 2 & 0 \\ 0 & 2 \end{pmatrix} \begin{pmatrix} x \\ y \end{pmatrix} + \begin{pmatrix} -\frac{1}{2} \\ -1 \end{pmatrix}$ (c) $\begin{pmatrix} 0 & 1 \\ 1 & 0 \end{pmatrix} \begin{pmatrix} x \\ y \end{pmatrix} + \begin{pmatrix} -3 \\ 3 \end{pmatrix}$
 (d) $\begin{pmatrix} -1 & 0 \\ 0 & -1 \end{pmatrix} \begin{pmatrix} x \\ y \end{pmatrix} + \begin{pmatrix} 3 \\ 5 \end{pmatrix}$ (e) $\begin{pmatrix} 1 & 0 \\ 0 & -1 \end{pmatrix} \begin{pmatrix} x \\ y \end{pmatrix} + \begin{pmatrix} 0 \\ 2 \end{pmatrix}$ (f) $\begin{pmatrix} 0 & 1 \\ -1 & 0 \end{pmatrix} \begin{pmatrix} x \\ y \end{pmatrix} + \begin{pmatrix} 4 \\ 0 \end{pmatrix}$

page 298 Exercise 14

1. rotation: $+90^\circ$, centre (0, 0) 2. reflection in y -axis
 3. reflection in $y = -x$ 4. reflection in $y = x$
 5. enlargement: scale factor 2, centre (0, 0) 6. enlargement: scale factor $\frac{1}{2}$, centre (0, 0)
 7. enlargement: scale factor -2 , centre (0, 0) 8. enlargement: scale factor $-\frac{1}{2}$, centre (0, 0)
 9. $\begin{pmatrix} 0 & -1 \\ 1 & 0 \end{pmatrix}$ 10. $\begin{pmatrix} 0 & 1 \\ 1 & 0 \end{pmatrix}$ 11. $\begin{pmatrix} -1 & 0 \\ 0 & -1 \end{pmatrix}$ 12. $\begin{pmatrix} -1 & 0 \\ 0 & -1 \end{pmatrix}$
 13. $\begin{pmatrix} 3 & 0 \\ 0 & 3 \end{pmatrix}$ 14. $\begin{pmatrix} 0 & -1 \\ -1 & 0 \end{pmatrix}$ 15. $\begin{pmatrix} -2 & 0 \\ 0 & -2 \end{pmatrix}$ 16. $\begin{pmatrix} 1 & 0 \\ 0 & -1 \end{pmatrix}$
 17. $\begin{pmatrix} 0 & 1 \\ -1 & 0 \end{pmatrix}$ 18. $\begin{pmatrix} \frac{1}{2} & 0 \\ 0 & \frac{1}{2} \end{pmatrix}$

page 299 Exercise 15

1. $x = 0$ (y -axis) 2. $y = 0$
 3. (a) stretch: parallel to x -axis, scale factor 3 (b) shear: x -axis invariant
 (c) shear: y -axis invariant (d) stretch: parallel to y -axis, scale factor 2
 4. stretch: parallel to x -axis, scale factor 2 5. stretch: parallel to x -axis, scale factor 3

6. stretch: parallel to y -axis, scale factor 2
 7. shear: x -axis invariant
 10. stretch: parallel to y -axis, scale factor 3
 12. $y = -x$
7. stretch: parallel to x -axis, scale factor $1\frac{1}{2}$
 9. stretch: parallel to x -axis, scale factor -2
 11. stretch: parallel to x -axis, scale factor $\frac{1}{2}$
 13. $y = -x$

page 300 **Revision exercise 9A**

1. (a) $\begin{pmatrix} 6 & 4 \\ 2 & 8 \end{pmatrix}$ (b) $\begin{pmatrix} 4 & -1 \\ 1 & 2 \end{pmatrix}$ (c) $\begin{pmatrix} 1\frac{1}{2} & 1 \\ \frac{1}{2} & 2 \end{pmatrix}$ (d) $\begin{pmatrix} -3 & 13 \\ -1 & 11 \end{pmatrix}$ (e) $\begin{pmatrix} 1 & 3 \\ 0 & 4 \end{pmatrix}$
2. (a) $\begin{pmatrix} -9 & -1 \\ 5 & 1\frac{1}{3} \end{pmatrix}$ (b) $\begin{pmatrix} 12 & 6 \\ 4 & 2 \end{pmatrix}$ (c) $\begin{pmatrix} 9 & -2 \\ 2 & -7 \end{pmatrix}$
3. (a) $(14); \begin{pmatrix} -1 & -15 \\ 3 & 15 \end{pmatrix}$ (b) $\mathbf{X} = \begin{pmatrix} 1 & 3 \\ 2 & 4 \end{pmatrix}$ 4. $\frac{1}{13} \begin{pmatrix} 5 & 1 \\ -3 & 2 \end{pmatrix}$
5. $x = 3; -\frac{1}{9} \begin{pmatrix} -1 & -2 \\ -3 & 3 \end{pmatrix}$ 6. $h = 4, k = -4$
7. (a) $a = \pm 4$ (b) $a = \pm 3$ 8. (a) $(4, -1)$ (b) $(4, 1)$ (c) $(-3, 2)$
9. (a) $A'(-3, -1) B'(1, -1) C'(-3, -7)$ (b) $A'(2, -2) B'(6, -2) C'(2, -8)$
 (c) $A'(1, 1) B'(2, 1) C'(1, -\frac{1}{2})$ (d) $A'(4, 2) B'(3, 2) C'(4, 3\frac{1}{2})$
 (e) $A'(-2, 2) B'(-6, 2) C'(-2, 8)$
10. (a) reflection in y -axis (b) reflection in $y = x$ (c) rotation, -90° , centre $(0, 0)$
 (d) reflection in $y = -x$ (e) rotation, 180° , centre $(0, 0)$ (f) rotation, -90° , centre $(0, 0)$
11. (a) reflection in $x = \frac{1}{2}$ (b) reflection in $y = -x$ (f) rotation, 180° , centre $(1, 1)$
12. (a) $(-1, -3)$ (b) $(-1, 3)$ (c) $(6, 2)$ (d) $(-3, 1)$ (e) $(-2, 6)$ (f) $(0, 2)$
13. (a) $(-1, 2)$ (b) $(1, -2)$ (c) $(10, -2)$ (d) $(6, -2)$ (e) $(-10, 2)$ (f) $(12, 2)$
14. (a) $(-2, 5)$ (b) $(-4, -3)$ (c) rotation, $+90^\circ$, centre $(0, 0)$
15. (a) rotation, $+90^\circ$, centre $(0, 0)$ (b) reflection in x -axis (c) rotation, 180° , centre $(0, 0)$
 (d) rotation, -90° , centre $(0, 0)$ (e) reflection in $y = -x$
16. (a) reflection in $y = x$ (b) reflection in y -axis
 (c) enlargement, scale factor 3, centre $(0, 0)$
17. (a) $\begin{pmatrix} -1 & 0 \\ 0 & -1 \end{pmatrix}$ (b) $\begin{pmatrix} 1 & 0 \\ 0 & -1 \end{pmatrix}$ (c) $\begin{pmatrix} 4 & 0 \\ 0 & 4 \end{pmatrix}$ (d) $\begin{pmatrix} 0 & -1 \\ -1 & 0 \end{pmatrix}$ (e) $\begin{pmatrix} 0 & 1 \\ -1 & 0 \end{pmatrix}$
18. (a) enlargement, scale factor 2, centre $(0, 0)$; translation $\begin{pmatrix} 5 \\ -2 \end{pmatrix}$
 (b) $(11, -4)$ (c) $(3, -1)$ (d) $(1, 3)$
19. (a) $\begin{pmatrix} 0 & 1 \\ 1 & 0 \end{pmatrix}$ (b) $\begin{pmatrix} -1 & 0 \\ 0 & 1 \end{pmatrix}$ (c) $\begin{pmatrix} 0 & 1 \\ -1 & 0 \end{pmatrix}$
 (d) $\begin{pmatrix} 0 & -1 \\ 1 & 0 \end{pmatrix}$ $\mathbf{AB} \equiv$ rotation -90° , centre $(0, 0)$
 $\mathbf{AB} \equiv$ rotation $+90^\circ$, centre $(0, 0)$

page 303 **Examination exercise 9B**

1. (a) (i) translation by $\begin{pmatrix} 3 \\ -3 \end{pmatrix}$ (ii) reflection in $y = x$ (iii) rotation of $+90^\circ$ about origin
 (b) $\begin{pmatrix} 0 & -1 \\ 1 & 0 \end{pmatrix}$ (c) reflection in y -axis (d) $\begin{pmatrix} -1 & 0 \\ 0 & 1 \end{pmatrix}$ (e) $y = x - 3$
2. 1 (a) (i) AC (b) 5 (c) $\frac{1}{3} \begin{pmatrix} 6 & -5 \\ 3 & -2 \end{pmatrix}$

3. (b) (iii) rotation of $+90^\circ$, about centre (1, 2)
 (c) (ii) stretch, parallel to y -axis, scale factor = -2
4. (b) B at (4, 2), (6, 6) and (8, 6)
 (c) C at $(-1, 2)$, (3, 3) and $(-3, 4)$
 (d) D at $(-4, 2)$, $(-5, 3)$ and $(-6, 3)$
 (e) E at (0, -3), (1, -1) and (2, -1)
 (f) (i) F at (1, 2), (3, 3) and (3, 4) (ii) reflection in $y = x$
 (g) (i) reflection in y -axis (ii) $\begin{pmatrix} -1 & 0 \\ 0 & 1 \end{pmatrix}$
5. (b) (i) vertices are (2, 6), (2, 8), (6, 16) (ii) 4 cm^2 (c) (i) $\begin{pmatrix} 1 & 0 \\ -2 & 1 \end{pmatrix}$ (ii) T
 (b) (iii) vertical shear, factor 2, points on y -axis invariant
6. (a) (i) reflection in y -axis (ii) translation $\begin{pmatrix} 5 \\ -1 \end{pmatrix}$ (iii) rotation of 180° about origin
 (b) (i) A, B (ii) E, D (c) (i) rotation of $+90^\circ$, about origin (ii) E, F
 (d) (i) $\frac{1}{2} \begin{pmatrix} 2 & 3 \\ 2 & 4 \end{pmatrix}$ (ii) G, H
7. (a) $\begin{pmatrix} 10 & 17 & 4 \\ -6 & -9 & 0 \end{pmatrix}$ (b) $\frac{1}{2} \begin{pmatrix} -2 & -4 \\ 3 & 5 \end{pmatrix}$ 8. (b) (ii) $\begin{pmatrix} 1 & 0 \\ 0 & 3 \end{pmatrix}$
9. (a) (i) F $\begin{pmatrix} 2 \\ -4 \end{pmatrix}$ (ii) $D \ x = 1$ (iii) $E \ (2, -1)$ (iv) $C \ \text{s.f. } 3$ (v) $A \ \text{Shear}$
 (b) $QP \ (-11 \ -17)$, $RS \ (12)$

10 Statistics and Probability

page 309 Exercise 1

1. (a) Squash (b) 160 (c) 10
 3. (a) \$3000 (b) \$4000 (c) \$6000 (d) \$11 000
 4. red 50° ; green 70° ; blue 110° ; yellow 40° ; pink 90°
 5. eggs 270° ; milk 12° ; butter 23.4° ; cheese 54° ; salt/pepper 0.6°
 6. (a) A 60° ; B 100° ; C 60° ; D 140° ; E 0°
 (b) A 50° ; B 75° ; C 170° ; D 40° ; E 25°
 (c) A 48.5° ; B 76.2° ; C 62.3° ; D 96.9° ; E 76.2°
 7. 18° , 54° , 54° , 234° 8. 80° , 120° , 160° 9. $x = 8$ 10. 100
 11. (a) 22.5% (b) $x = 45^\circ$, $y = 114^\circ$ 12. (a) 144° (b) posters 5% , cinema 1%
 13. Area of second apple looks much more than twice area of first.
 14. Vertical axis starts at 130.

page 312 Exercise 2

Frequency densities for histograms are given here.

1. 1, 1.4, 0.3 2. 1, 0.6, 1.2, 1.7, 1.3, 0.25
 3. 0.5, 1.4, 2, 1, 0.2 4. 1.8, 9.2, 7, 1.3, 0.8
 5. 0.55, 1.8, 0.7, 0.25 6. 1.6, 3.4, 2.8, 0.73
 7. 8, 11, 6, 4, 1, 0.5

page 316 Exercise 3

1. (a) mean = 6; median = 5; mode = 4. (b) mean = 9; median = 7; mode = 7.
(c) mean = 6.5; median = 8; mode = 9. (d) mean = 3.5; median = 3.5; mode = 4.
2. (a) mean = 7.82; median = 8; mode = 8. (b) mean = 5; median = 4; mode = 4.
(c) mean = 2.1; median = 2.5; mode = 4. (d) mean = $\frac{13}{18}$; median = $\frac{1}{2}$; mode = $\frac{1}{2}$.
3. 78 kg 4. 35.2 cm 5. (a) 2 (b) 9
6. (a) 20.4 m (b) 12.8 m (c) 1.66 m 7. 55 kg 8. 12
9. mean = 17, median = 3. The median is more representative.
10. the median.
11. many answers (e.g. 4, 4, 6, 10, 11)
12. 3.38
13. 3.475
14. (a) mean = 3.025; median = 3; mode = 3. (b) mean = 17.75; median = 17; mode = 17.
(c) mean = 3.38; median = 4; mode = 4.
15. (a) 5.17 (b) 5
16. (i) 9 (ii) 9 (iii) 15 17. (i) 5 (ii) 10 (iii) 10
18. 12 19. $3\frac{2}{3}$ 20. 4.68 21. (a) 68.25

page 322 Exercise 4

2. (a) strong positive correlation (b) no correlation
(c) weak negative correlation
3. 11 4. 9
5. no correlation 6. (c) about 26 (d) about 46
7. (b) 33 m.p.g. (c) 63 m.p.h.

page 325 Exercise 5

1. (a) 47 (b) 30, 63 (c) 33 (d) 37 (e) 23
2. (a) 32 (b) 26, 43 (c) 17 (d) 30 (e) 84
3. (a) 20 kg (b) 10.5 kg 4. (a) 80.5 cm (b) 22 cm
5. (a) 71 s (b) 20 s 6. (a) 45 (b) 14
7. (a) 36.5 g (b) 20 g (c) 25
8. (a) 26 (b) 25.2 (c) 26.1

page 329 Exercise 6

1. (a) $\frac{1}{6}$ (b) $\frac{1}{2}$ (c) $\frac{1}{2}$ (d) $\frac{1}{3}$
2. (a) $\frac{1}{4}$ (b) $\frac{1}{2}$
3. (a) (i) $\frac{3}{5}$ (ii) $\frac{2}{5}$ (b) (i) $\frac{5}{9}$ (ii) $\frac{4}{9}$
4. (a) $\frac{1}{11}$ (b) $\frac{2}{11}$ (c) 0 (d) $\frac{1}{11}$
5. (a) $\frac{1}{8}$ (b) $\frac{3}{8}$ (c) $\frac{1}{8}$ (d) $\frac{7}{8}$
6. (a) $\frac{5}{11}$ (b) $\frac{7}{22}$ (c) $\frac{15}{22}$ (d) $\frac{17}{22}$
7. (a) $\frac{1}{2}$ (b) $\frac{3}{25}$ (c) $\frac{9}{100}$ (d) $\frac{2}{25}$
8. (a) $\frac{1}{12}$ (b) $\frac{1}{36}$ (c) $\frac{5}{18}$ (d) $\frac{1}{6}$ (e) $\frac{1}{6}$; most likely total = 7.
9. (a) $\frac{1}{12}$ (b) $\frac{5}{36}$ (c) $\frac{2}{3}$ (d) $\frac{1}{12}$ (e) $\frac{1}{36}$
10. (a) 1 (b) 0 (c) 1 (d) 0
11. (a) $\frac{3}{8}$ (b) $\frac{1}{16}$ (c) $\frac{15}{16}$ (d) $\frac{1}{4}$
12. $\frac{5}{999}$ 13. $\frac{271}{1000}$ 14. $\frac{x}{12}$, 3

15. (a) $\frac{1}{144}$ (b) $\frac{1}{18}$ (c) $\frac{1}{72}$; head, tail and total of 7.
 16. (a) $\frac{1}{216}$ (b) $\frac{1}{72}$ (c) $\frac{1}{8}$ (d) $\frac{5}{108}$ (e) $\frac{5}{72}$ (f) $\frac{1}{36}$

page 332 **Exercise 7**

1. (a) $\frac{1}{2}$ (b) $\frac{1}{2}$ (c) $\frac{1}{4}$ 2. (a) $\frac{1}{16}$ (b) $\frac{25}{144}$
 3. (a) $\frac{1}{121}$ (b) $\frac{9}{121}$ 4. (a) $\frac{1}{288}$ (b) $\frac{1}{72}$
 5. (a) $\frac{1}{125}$ (b) $\frac{1}{125}$ (c) $\frac{1}{10000}$ (d) $\frac{3}{500}$ (e) $\frac{3}{500}$
 6. (a) $\frac{1}{9}$ (b) $\frac{4}{27}$ (c) $\frac{4}{9}$

page 333 **Exercise 8**

1. (a) $\frac{49}{100}$ (b) $\frac{9}{100}$ 2. (a) $\frac{9}{64}$ (b) $\frac{15}{64}$ 3. (a) $\frac{7}{15}$ (b) $\frac{1}{15}$
 4. (a) $\frac{2}{9}$ (b) $\frac{2}{15}$ (c) $\frac{1}{45}$ (d) $\frac{14}{45}$
 5. (a) $\frac{1}{12}$ (b) $\frac{1}{6}$ (c) $\frac{1}{3}$ (d) $\frac{2}{9}$
 6. (a) $\frac{1}{216}$ (b) $\frac{125}{216}$ (c) $\frac{25}{72}$ (d) $\frac{91}{216}$
 7. (a) $\frac{1}{6}$ (b) $\frac{1}{30}$ (c) $\frac{1}{30}$ (d) $\frac{29}{30}$
 8. (a) $\frac{27}{64}$ (b) $\frac{1}{64}$
 9. (a) 6 (b) $\frac{1}{3}$
 10. (a) $\frac{1}{64}$ (b) $\frac{27}{64}$ (c) $\frac{9}{64}$ (d) $\frac{27}{64}$; Sum = 1
 11. (a) $\frac{3}{20} \times \frac{2}{19} \times \frac{1}{18} (= \frac{1}{1140})$ (b) $\frac{1}{4} \times \frac{4}{19} \times \frac{1}{16} (= \frac{1}{114})$
 (c) $(\frac{3}{20} \times \frac{5}{19} \times \frac{12}{18}) \times 6$ (d) $\frac{5}{20} \times \frac{4}{19} \times \frac{3}{18} \times \frac{2}{17}$
 12. (a) $\frac{1}{10000}$ (b) $\frac{523}{10000}$ (c) $\frac{9^4}{10^4}$
 13. (a) $\frac{x}{x+y}$ (b) $\frac{x(x-1)}{(x+y)(x+y-1)}$ (c) $\frac{2xy}{(x+y)(x+y-1)}$ (d) $\frac{y(y-1)}{(x+y)(x+y-1)}$
 14. (a) $\frac{1}{5}$ (b) $\frac{18}{25}$ (c) $\frac{1}{20}$ (d) $\frac{2}{25}$ (e) $\frac{77}{100}$
 15. $\frac{3}{10}$ 16. $\frac{9}{140}$ 17. (a) 5 (b) $\frac{1}{64}$
 18. (a) $\frac{3}{5}$ (b) $\frac{1}{3}$ (c) $\frac{2}{15}$ (d) $\frac{2}{21}$ (e) $\frac{1}{7}$ (f) $\frac{1}{35}$
 19. (a) $\frac{1}{220}$ (b) $\frac{1}{22}$ (c) $\frac{3}{11}$ (d) 5 (e) 300
 20. (a) $\frac{10 \times 9}{1000 \times 999}$ (b) $\frac{990 \times 989}{1000 \times 999}$ (c) $\frac{2 \times 10 \times 990}{1000 \times 999}$
 21. (a) $\frac{3}{20}$ (b) $\frac{7}{20}$ (c) $\frac{1}{2}$
 22. (a) 0.00781 (b) 0.511 23. (a) $\frac{21}{506}$ (b) $\frac{455}{2024}$ (c) $\frac{945}{2024}$

page 337 **Revision exercise 10A**

1. 162° 2. 41.7% 3. 54°
 4. (a) 84 (b) 19.2 5. (a) 3.4 (b) 3 (c) 3
 6. (a) 5.45 (b) 5 (c) 5 7. 1.552 m 8. 3
 9. $\frac{1}{6}$ 10. (a) 5 (b) $\frac{4}{25}$ 11. $\frac{8}{27}$ 12. $\frac{5}{16}$
 13. (a) $\frac{1}{28}$ (b) $\frac{15}{28}$ (c) $\frac{3}{7}$

14. (a) $\frac{x}{x+5}$ (b) $\left(\frac{x}{x+5}\right)^2; \frac{x}{x+5}, \frac{x(x-1)}{(x+5)(x+4)}$
15. $\frac{1}{19}$ 16. (a) $\frac{1}{32}$ (b) $\frac{1}{256}$ 17. (a) $\frac{1}{8}$ (b) $\frac{1}{2}$
18. $\frac{35}{48}$ 19. (a) $\frac{1}{9}$ (b) $\frac{1}{12}$ (c) 0 20. $\frac{1}{20^3}$

page 339 Examination exercise 10B

1. (a) 105° (b) $\frac{3}{8}$ (c) 810 2. 6 3. 6, 7, 8, 9
4. (a) \$36.25 (b) $p = 12, q = 24, r = 35$ (d) (i) $\approx \$37$ (ii) $\approx \$45, \$28, \$17$
5. (a) blocks with widths of 4, 2, 2, 2 and 6 cm with heights 2.5, 7, 11.3, 9.2 and 2.5 cm respectively.
(b) ≈ 118 g (c) 70%
6. (a) $\frac{3}{10}$ (c) (i) $\frac{2}{9}$ (ii) $\frac{1}{3}$ (iii) $\frac{8}{15}$ (d) 0
7. (c) (i) $\frac{11}{35}$ (ii) $\frac{6}{35}$ (iii) $\frac{18}{35}$ (d) (i) $\frac{22}{133}$ (ii) $\frac{111}{133}$
8. (b) (i) 0.16 (ii) 0.992 (iii) 0.001 28 (c) $(0.2)^n$
9. (a) (i) $10 < M \leq 15$ (ii) 18.9 kg (iii) 36°

11 Investigations, Practical Problems, Puzzles

page 343 11.1 Investigations

Note: It must be emphasised that the *process* of obtaining reliable results is far more important than these few results. It is not suggested that 'obtaining a formula' is the only aim of these coursework tasks. The results are given here for some of the investigations merely as a check for teachers or students working on their own.

It is not possible to summarise the enormous number of variations which students might think of for themselves. Obviously some original thoughts will be productive while many others will soon 'dry up'.

1. With the numbers written in c columns, the difference for a $(n \times n)$ square is $(n-1)^2 \times c$.

8. (a) For n blacks and n whites, number of moves $= \frac{n(n+1)}{2}$.

(b) For n blacks and n whites, number of moves $= \frac{n(n+2)}{2}$.

(c) For n of each colour, number of moves $= \frac{3}{2}n(n+1)$.

9. 4×4 : There are 30 squares (i.e. $16 + 9 + 4 + 1$)

8×8 : There are 204 squares ($64 + 49 + 36 + 25 + 16 + 9 + 4 + 1$)

$n \times n$: Number of squares $= 1^2 + 2^2 + 3^2 + \dots + n^2$

$$= \frac{n}{6}(n+1)(2n+1)$$

This could be found using method of differences or from the standard result for $\sum_1^n r^2$.

14. For $n \times n \times n$: 3 green faces $= 8$

2 green faces $= 12(n-2)$

1 green face $= 6(n-2)^2$

0 green face $= (n-2)^3$

18. For a square card, corner cut out $= \frac{1}{6}$ (size of card).

For a rectangle $a \times 2a$, corner cut out $\cong \frac{a}{4.732}$.

20. For diagram number n , number of squares $= 2n^2 - 2n + 1$.

21. (a) Another Fibonacci sequence.

(b) Terms are alternate terms of original sequence.

(c) Ratio tends towards 1.618 (to 4 s.f.), the 'Golden Ratio'

(d) (first \times fourth) $=$ (second \times third) $+ 1$

(e) (first \times third) $\pm 1 =$ (second)², alternating $+$ and $-$

(f) sum of 10 terms $= 11 \times$ seventh term.

(g) For six terms $a b c d e f$ let $x = e \times f - (a^2 + b^2 + c^2 + d^2 + e^2)$

	x	first difference
first six	0	1
second six	1	1
third six	2	4
fourth six	6	9
fifth six	15	25
sixth six	40	64
seventh six	104	169
eighth six	279	

The numbers in the first difference column are the squares of the terms in the original Fibonacci sequence.

22. For n names, maximum possible number of interchanges $= \frac{n(n-1)}{2}$.

24. Consider three cases of rectangles $m \times n$

(a) m and n have no common factor. Number of squares $= m + n - 1$.

e.g. 3×7 , number $= 3 + 7 - 1 = 9$

(b) n is a multiple of m . Number of squares $= n$ e.g. 3×12 , number $= 12$

(c) m and n share a common factor a

so $m \times n = a(m' + n')$

number of squares $= a(m' + n' - 1)$

e.g. $640 \times 250 = 10(64 \times 25)$, number of squares $= 10(64 + 25 - 1) = 880$.

26. For smallest surface area, height of cylinder $= 2 \times$ radius.

27. (a) square root twice, 'multiply by x ' gives cube root of x .

(b) square root three times, 'multiply by x ' gives seventh root of x .

(c) square root twice, 'divide by x ' gives $1/(\sqrt[3]{x})$

(d) square root twice, 'multiply by x^2 ' gives $(\sqrt[3]{x})^2$

28. Pick's theorem: $A = i + \frac{1}{2}p - 1$

12 Revision tests

page 366 Test 1

- | | | | | |
|-------|-------|-------|-------|-------|
| 1. C | 2. D | 3. D | 4. B | 5. A |
| 6. C | 7. A | 8. C | 9. C | 10. B |
| 11. C | 12. A | 13. D | 14. C | 15. C |
| 16. D | 17. A | 18. C | 19. B | 20. D |
| 21. A | 22. C | 23. B | 24. B | 25. C |

page 369 Test 2

- | | | | | |
|-------|-------|-------|-------|-------|
| 1. B | 2. C | 3. A | 4. B | 5. D |
| 6. C | 7. A | 8. D | 9. B | 10. C |
| 11. B | 12. D | 13. A | 14. D | 15. C |
| 16. D | 17. B | 18. A | 19. B | 20. B |
| 21. C | 22. D | 23. A | 24. A | 25. B |

page 371 Test 3

- | | | | | |
|-------|-------|-------|-------|-------|
| 1. D | 2. D | 3. D | 4. B | 5. A |
| 6. C | 7. A | 8. D | 9. D | 10. B |
| 11. C | 12. D | 13. D | 14. B | 15. A |
| 16. B | 17. C | 18. A | 19. D | 20. D |
| 21. C | 22. A | 23. B | 24. B | 25. D |

page 374 Test 4

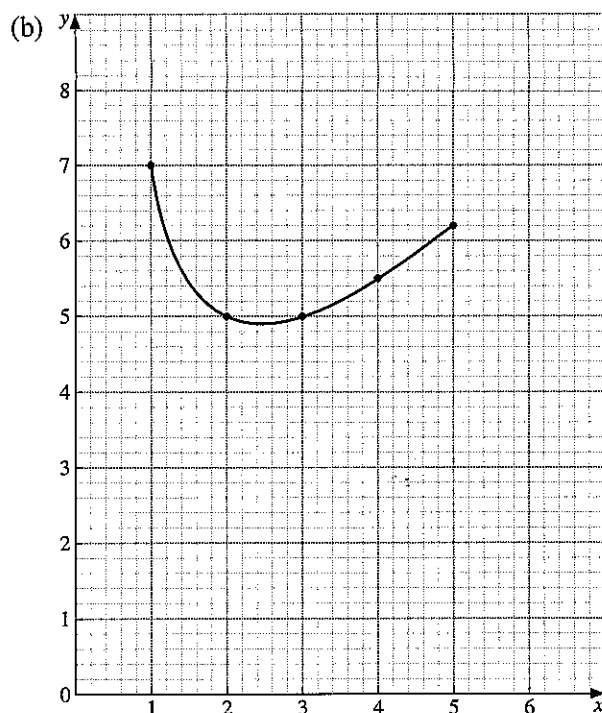
- | | | | | |
|-------|-------|-------|-------|-------|
| 1. B | 2. B | 3. A | 4. C | 5. D |
| 6. A | 7. B | 8. C | 9. D | 10. B |
| 11. C | 12. A | 13. B | 14. B | 15. D |
| 16. A | 17. C | 18. B | 19. B | 20. D |
| 21. A | 22. C | 23. C | 24. C | 25. A |

Specimen Paper 2

page 378

1. $\frac{4}{5}$ 2. 265 min 3. $x < 6$
4. (a) $\frac{1}{8} \times 100 = 12\frac{1}{2}\%$ (b) $14(-3)\%$ 5. 1.4×10^{-3} 6. 15 7. \$400
8. (a) 0.45, 0.444 444 444, 0.445 945 945 (b) $\frac{33}{74}$
9. (a) -3 (b) -7 10. (a) 4.25 m, 3.75 m (b) 11.7 m^2 , 8.44 m^2
11. $x = 4$, $y = -1$ 12. 4000
13. (a) (i) 090° (ii) 224° (b) 1760 km 14. (a) (i) 54 (ii) 57 (b) $C = 8N + 1$
15. (a) Diagram (i) (b) Diagram (ii) 4:1; Diagram (iii) 8:1
16. (a) A triangle with vertices (2, -2), (-4, -4) and (-4, -8) (b) 12 square units
17. (a) $xy = k$ or $y = \frac{k}{x}$ (b) y increases by 25%

18. (a)
- | | | | | | |
|-----|---|---|---|-----|-----|
| x | 1 | 2 | 3 | 4 | 5 |
| y | 7 | 5 | 5 | 5.5 | 6.2 |

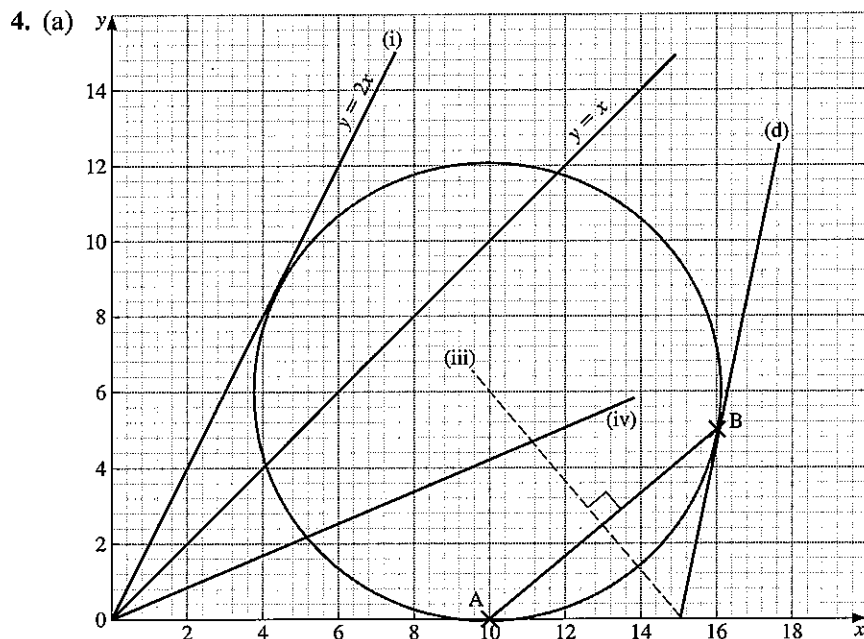


19. (a) $\begin{pmatrix} 5 \\ -1 \end{pmatrix}$ (b) C has vertices $(-2, 5)$, $(-2, 7)$ and $(-4, 7)$
 (c) Rotation 90° clockwise about the point $(0, 0)$
 20. (a) $XY = XW = 5$ cm, $YZ = WZ = 10.4$ cm (b) $\angle YZW = 33.4^\circ$
 21. (b) 9.60 cm (c) 24.0 cm²
 22. (b) (i) 2 800 000 000 or 2.8 thousand million (ii) 2.8×10^9
 (c) approximately 20 million per year (d) approximately 7 thousand million
 23. $a = 38^\circ$, $b = 71^\circ$, $c = 64^\circ$

Specimen Paper 4

page 383

1. (a) (i) 36 (ii) -8 (b) $4\frac{1}{2}$ (c) $+5, -5$
 (d) $\times 9$ (e) $p = \sqrt{\frac{r(q-3)}{2}}$
 2. (a) (i) $2x$ (ii) $\vec{EC} = \vec{ED} + \vec{DC}$ (iii) $\vec{AE} = 2y - z$ $\vec{CA} = 2z - x$
 (b) $x + y + z$
 (c) $x + y + z = 0$
 (d) $\vec{BE} = 2y - x - z = 2y + y$ (using (c)) $= 3y$
 BE and CD are parallel.
 3. (a) (i) 94.2 cm³ (ii) 104 cm²
 (b) 268 g



(b) $y = 2x$

(c) $(15, 0)$

5. (a) (i) 14.4 cm (ii) 24.8 cm^2

(b) (i) 31.6° (ii) 17.9°

6. (a) $10x - 30$ (b) $(3x - 8)(2x - 7)$

(d) (i) $(6x + 5)(x - 7)$ (ii) $x = -\frac{5}{6}$ or 7

(e) length 13 cm , width 7 cm

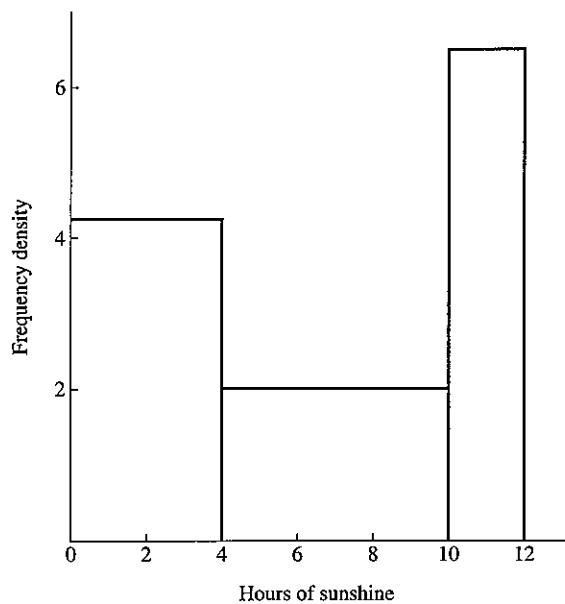
7. (a) (ii) $\frac{1}{36}$ (iii) $\frac{5}{36}$ (iv) 11

(b) (i) 0.42 (ii) 0.16 (iii) 0.34

8. (a) $6\text{--}10 \text{ hours}$

(b) (i) $10 < N \leq 12$ (ii) $5 \text{ h } 20 \text{ m}$

(d)



9. (a)

Selling price	Number sold	Sales revenue (\$)
60	6000	360 000
70	5500	385 000
80	5000	400 000
90	4500	405 000
100	4000	400 000
110	3500	385 000
120	3000	360 000

(c) (i) \$90 (ii) 4500

10. (a) 76, 123, 199

(b) (i) $\begin{pmatrix} 29 \\ 18 \end{pmatrix}$ (c) (i) $\begin{pmatrix} 2 & 1 \\ 1 & 1 \end{pmatrix}$ (ii) $\begin{pmatrix} 47 \\ 29 \end{pmatrix}$